NATIONAL COOPERATIVE SOIL SURVEY

Southern Regional Conference Proceedings

Knoxville, Tennessee
June 13-17, 1988


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# Proceedings Of Southern Regional Technical Work-Planning Conference Of The National Cooperative Soil Survey

Knoxville, Tennessee
June 13-17, 1988

U.S. Department of Agriculture
Soil Conservation Service

United States
Department of
Agriculture

Soil
Conservation
Service

675 Estes Kefauver FB-USCH
Nashville, Tennessee 37203

September 26, 1988

TO: Recipients of Proceedings

SUBJECT: 1988 Southern Regional Technical Work Planning Conference of the National Cooperative Soil Survey.

The 1988 Southern Regional Technical Work Planning Conference convened at 8:00 a.m. Monday, June 13, at the Holiday Inn Worlds Fair, Knoxville, Tennessee. The conference included an opening session, reports relative to the national cooperative soil survey, various invited speakers and ample time for committee activities and reports. There was also two half-day field trips and several social activities. The conference adjourned at 1:30 a.m. June 17.

The program committee extends its special thanks and appreciation to those who participated in the conference. Written reports received from the participants are included in the proceeding. Committee chairmen and members are commended for their time and effort prior to the conference and during the conference in conducting individual discussion groups and presenting reports. All of the final reports are included in these proceeding along with the taxonomy committee report.

Puerto Rico will be the host for 1988. Dr. Fred Beinroth, Professor, Department of Agronomy, University of Puerto Rico, will serve as chairman and Gilberto Acevedo, Staff Soil Scientist with the Soil Conservation Service will serve as vice chairman.

Darwin L. Newton
Chairman

John T. Ammons
Vice Chairman

# INTRODUCTION

The purpose of the Southern Regional Technical Work-Planning Conference is to provide a forum for Southern States representatives of the National Cooperative Soil Survey and invited participants for discussing technical and scientific developments pertaining to soil surveys. Through conference discussions and committee actions current issues are addressed, new ideas are exchanged and disseminated, new procedures are proposed, new techniques are tested, and conventional methods and materials are evaluated. Sharing individual experiences related to soil survey increases the participants proficiency in these research and teaching programs. Conference recommendations and proposals are forwarded to the National Technical Work-Planning Conference. Thus, the results form a basis for new or revised National Soil Survey policy or procedures, or both.

RESOLUTION: Bobby Joe Miller

Whereas, the SRWPC is composed of several agencies with the objective to exchange information and ideas regarding the National Cooperative Soil Survey, and

Whereas, Bobby Joe Miller served this organization as a member of the Soil Conservation Service and the Agricultural Experiment Station, and

Whereas, Bobby Joe Miller was recognized as an educator, researcher and friend of those associated with the NGSS and soil science, and

Whereas, Bobby Joe Miller dedicated his life to strengthen and promote soil science, and

Be it resolved that: The SRWPC hereby recognizes Bobby Joe Miller's contribution to the SRWPC, NCSS, and to soil science, and

Be it further resolved that: A copy of this resolution be a part of the proceedings of the 1988 SRWPC and a copy be presented to his wife, Ellen and his children, Paul, Linda and Robert.

Southern Regional Technical Work Planning Conference
of the
Cooperative Soil Survey
Knoxville, Tennessee
June 13-17, 1988

Sunday, June 12

3:00 - 6:00 p.m. Registration, Holiday Inn World's Fair

Monday, June 13, 1988

8:00 a.m. - 12:00 Noon Registration

Darwin L. Newton, Moderator

8:30 a.m. Introductions and Announcements

Opening Comments:

D. M. Gossett, Vice President
Institute of Agriculture
University of Tennessee
Knoxville, Tennessee

Jerry S. Lee
State Conservationist
USDA-Soil Conservation Service
Nashville, Tennessee

D. O. Richardson, Dean
Agricultural Experiment Station
University of Tennessee
Knoxville, Tennessee

Paul F. Larson, Director
South National Technical Center
USDA-Soil Conservation Service
Fort Worth, Texas

Don Rollins, Forest Supervisor
Cherokee National Forest
U. S. Forest Service
Cleveland, Tennessee

9:45 a.m Tennessee It's Land and It's People

Darwin L. Newton

| | | PAGE |
|---|---|---|
| 10:00 a.m. | BREAK | |
| 10:30 a.m. | National Cooperative Soil Survey - Outlook and status<br><br>Ellis Knox<br>Soil Survey Investigations<br>USDA-Soil Conservation Service<br>Washington, DC<br><br>Everett Emino<br>Assistant Dean for Research<br>University of Florida<br>Gainesville, Florida<br><br>Jerry Ragus<br>U. S. Forest Service<br>Atlanta, Georgia | 1 |
| 11:30 a.m. | LUNCH | |
| | <u>Tom Ammons, Moderator</u> | |
| 12:30 p.m. | University of Tennessee - Plant and Soil Science Department<br><br>John Foss | |
| 1:00 p.m. | National Soil Survey Quality Assurance Staff<br><br>Jerry Post | 5 |
| 1:30 p.m. | Cartographic Support to the National Cooperative Soil Survey<br><br>Carter Steers | 9 |
| 2:00 p.m. | National Soil Survey Laboratory Activities<br><br>Warren Lynn | 13 |
| 2:30 p.m. | BREAK | |
| 3:00 p.m. | Reports from the North Central Region Soil Survey Work Planning Conference<br><br>James Culver | 24 |

| | | PAGE |
|---|---|---|
| 3:30 p.m. | NCSS Laboratory Data Base<br>Benny R. Brasher | 27 |
| 4:00 p.m. | ICOMOD Report<br>Horace Smith | |
| 5:00 p.m. | MIXER | |

Tuesday, June 14, 1988

Ed Lewis, Moderator

| | | |
|---|---|---|
| 8:00 a.m. | GIS and Remote Sensing Activities in the National Cooperative Soil Survey<br>Carter Steers | |
| 8:30 a.m. | International Committee Activities<br>Joe Nichols | 31 |
| 9:00 a.m. | GIS Activities - TVA<br>Charlie Smart | |
| 9:30 a.m. | BREAK | |
| 10:00 a.m. | Remote Sensing Activities - Middle Tennessee State University<br>Norris Colvert | |
| 10:30 a.m. | Spot Imagery for Soil Surveys<br>R. H. Griffin | 32 |
| 11:00 a.m. | Remote Sensing Activities - TVA<br>Frank Perchalski | |

| | | |
|---|---|---|
| 11:30 a.m. | LUNCH | |
| 12:00 Noon | Field Trip<br>Great Smoky Mountain National Park | |

| Friday, June 17, 1988 | | PAGE |
|---|---|---|
| | Barry Davis, Moderator | |
| 8:00 - 9:30 a.m. | Committee Reports | 50 |
| | I. Soil Laboratory Data Bases | 52 |
| | II. Soil Interpretations | 55 |
| | III. Laboratory Methods and Analysis | 57 |
| | IV. Soil Water | 77 |
| | V. Soil Survey and Management of Forest Lands | 90 |
| | VI. Minesoil, Classification and Interpretations | 102 |
| 9:30 - 9:45 a.m. | BREAK | |
| 9:45 - 10:45 a.m. | Business Meeting | 105 |
| 10:45 - 11:15 a.m. | Closing Comments<br>J. T. Ammons<br>Joe Nichols | |


Mailing List 107

Participants 116

Southern Regional Technical Work Planning Conference of the Cooperative Soil Survey
13-17 June 1988, Knoxville, TN

# National Cooperative Soil Survey--Outlook and Status

Ellis G. Knox, Soil Conservation Service, Washington, DC

## Introduction

Greetings from Washington, DC. Bill Roth, soil survey program development specialist, and I are happy to represent SCS national headquarters at your conference. We will be here all week and we will be happy to talk with you, discuss your comments and suggestions, receive your criticisms, and answer your questions if we can. This is my second opportunity to attend a southern regional conference. If I continue to come every time, in just 14 more years my southern and western conference experience will be equal.

## Tennessee News

Darwin Newton has been made adjunct assistant professor at the University of Tennessee in the Department of Plant and Soil Science. Tom Ammons and others in that department are or will be taking part in soil-archaeological projects in Crete and Pompeii. We have good reason to believe that Bobby Birdwell is in Tennessee this week but he is not at this meeting because this is his first week of retirement.

## Women in Soil Survey

The Soil Conservation Service is an equal opportunity employer. I don't have any new information about minority soil scientists in the SCS, but there is good news and bad news about women. The bad news is that the Southern Region lost Carol Wettstein as its only female soil scientist at the state office level. The good news is that now, in Maryland, she is the first female State Soil Scientist. There are three other women in state office positions, in California, Utah, and South Dakota. Maryland also has a woman as Deputy State Conservationist and in July, Barbara Osgood will go to New Jersey as the first female State Conservationist.

## Realignment of SCS Soil Survey Functions and Organization

A number of changes have been made in the soil survey during the last 15 months or so. These changes were recommended by the Productivity Improvement Program (PIP) report of 3 Feb 87. PIP was the third major study of soil survey this decade.

The first, the Grace Commission study of 1981 or 1982, found that CASPUSS is not a good management tool, that surveys should be scheduled and managed to be finished within five years, and that editing of survey manuscripts needed to be better coordinated with other aspects of the publication program. Changes in editing and scheduling have been made and a new Soil Survey Scheduling system is about to be implemented.

For the second major study, the SCS Soil Survey Program Evaluation, 1983 was the target year for collection of data on effectiveness of the work. The evaluation, completed in 1987, prompted a number of relatively small program improvements and the following statement of the soil survey mission:

> To assist mankind in understanding and wisely using soil resources to achieve a sustainable and desirable quality of life by--

- o Maintaining a strong scientific basis for defining and describing soil relationships important to decisions about the formation, use, and management of soils.
- o Providing scientific expertise to identify, classify, map, and interpret soils.
- o Making field and laboratory information readily available through texts, maps, and other forms of data bases and helping people use the information.

The PIP team, from June 1985 to December 1986, with Ken Hinkley (former Assistantt Director of the Soil Survey Division) as technical advisor, studied the work load and functions at all levels of soil survey in the SCS "to find the most effective and efficient organization for accomplishing the agency objectives for the soil survey program.. ." The report recommended changes in assignment of functions and responsibilities and changes in structure.

As a result of the PIP study, the responsibility for quality coordinate the National Cooperative Soil Survey activities in the region.

A number of functions have been shifted from National Headquarters and the National Technical Centers to a new National Soil Survey Center in Lincoln, NE. Although it is clearly national in scope it is attached to the Midwest NTC. Steve Holzhey as an Assistant Director of the Soil Survey Division is head of the National Soil Survey Center. Five national leaders will work under his supervision. Three supervisory soil scientists under the direction of Rod Harner in Soil Survey Quality Assurance work in geographic areas defined by Land Resource Regions rather than by states. I'm National Leader for Soil Survey Investigations. The National Soil Survey Laboratory will include all of the investigations staff at Lincoln. We intend to add a new position in soil-geomorphology studies. There will be a few people in special assignments at other locations. Maurie Mausbach has been acting National Leader for Interpretations. Applications are being received for that position and for National Leader for Data Bases. John Witty continues as National Leader for Soil Classification.

At National Headquarters, Dick Arnold is Director of the Soil Survey Division. Bobbie Birdwell's retirement makes a vacancy for Assistant Director which will be announced soon. Bill Reybold is National Leader for Soil Geography. He and his staff and Soil Management Support Services will continue to be in Washington.

## Food Security Act

U.S. cropland (431 million acres) and potential cropland (146 million acres) must be mapped by 1990 to meet the requirements of the Food Security Act of 1985. At the end of fiscal year 1987, 59 of the 577 million FSA acres remained to be mapped. In fiscal year 1987, 23 million acres were mapped. This annual production rate was encouraging but greater production is needed in 1988 and 1989. In the summer of 1987, there were 54 soil scientists on mapping details. This year, there are 65. New soil scientists were recruited this year and there are current vacancy announcements for GS 9 and 11 soil scientists.

## Future of Soil Survey

I perceive a strong commitment in the Soil Survey Division and in the SCS in general to the future of the soil survey. To be sure, there are some Programs people who think that the Computer Assisted Management and Planning System (CAMPS) in SCS field offices will soon include all necessary information about soils and that no further soils work will be needed. The prevailing view, though, seems to be that the SCS will need an active soil survey program long after

FSA requirements for mapping cropland and potential cropland have been met.

A survey of State Conservationists in September 1967 about the Technology Deputy Chief area, which includes soil survey, indicated that more than 1/3 give a high priority and more than 2/3 give a high or medium priority to updating old soil surveys and that they are concerned about water quality, support staying up-to-date with new technology and implementing GIS technology, see the need for training and recruiting new people at the M.S. and PhD degree levels, and consider computers, modelling, and expert systems to be important. None of this suggest the decline of the soil survey.

The two top priority resource goals of the USDA for 1988 through 1997 are to reduce the damage caused by excessive soil erosion and to protect the quality of ground and surface water. The SCS will have a major role in federal water quality programs and the soil survey will have important contributions to make. Don Goss of the NSSL is hard at work now as part of the SCS Water Quality Action Plan to get water quality interpretations in place in technical guides by the end of the year. Soil maps and the soils data bases will be be needed to drive models and to apply knowledge and programs to specific land areas. We will need much better knowledge of soil variability and the composition of map units. The soil survey may change but it does not seem likely that it will fade away.

State Soil Scientists and State Conservationists or their deputies and agricultural experiment station representatives from six midwestern states, where the current round of mapping is or soon will be complete, met in March to plan for the future of the soil survey. Similar meetings are projected in the other regions. Creation of the new National Soil Survey Center in Lincoln reflects the view that soil survey continues to be important and confidence that soil survey activities will be supported.

This week we can work toward understanding the needs and planning for the soil survey of the future.

SCS - GENERAL MANUAL

PART 404- ORGANIZATION

SUBPART C - NATIONAL TECHNICAL CENTERS

§404.26 NTC soil interpretation staffs.

The soils staffs guide and assist other NTC staffs in the integration of soils information into technology development and transfer activities and furnish training and technical assistance to states in the application of soil technology. The soils staffs coordinate the national cooperative soil survey activities in the area.

§404.32 National soil survey center (Midwest NTC).

The national soil survey staff furnishes technical assistance on scientific phases of soil surveys, including mapping, classification, correlation, data bases, interpretation, investigation, editing, and publications. The services offered by this staff include soil analyses and research in soil classification, morpholrgy, and interpretation and research in the physics rnd chemistry of soil genesis.

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NATIONAL SOIL SURVEY QUALITY ASSURANCE STAFF

Responsibility and Function

It is the responsibility of the National Soil Survey Quality Assurance Staff to assure that quality control is being carried out by the states. Quality assurance is an oversight function. It will require a continual close working relationship with state staffs.

Quality assurance will be carried out through the following functions:

FUNCTION: Review memorandum of understanding.

Emphasis Items

- Purpose of the soil survey
- Guidance on soil survey procedures
- Average size of management unit
- Maximum size of contrasting inclusions
- Hap scale
- Schedule for completion

FUNCTION: Participate in initial field review or early progress reviev.

Emphasis Items

- Design and description of map units

- status of manuscript

- Matching of maps with adjoining soil surveys

FUNCTION: Review of draft of final correlation.

Emphasis Items

- Naming of map units

- Problems and deficiencies noted at final field review.

FUNCTION: Training.

Emphasis Items

- Basic Soil Survey Course

- Soil correlation course

- NTC workshops for state soils staffs

- Participate in state workshops

- Training of individuals in NTC

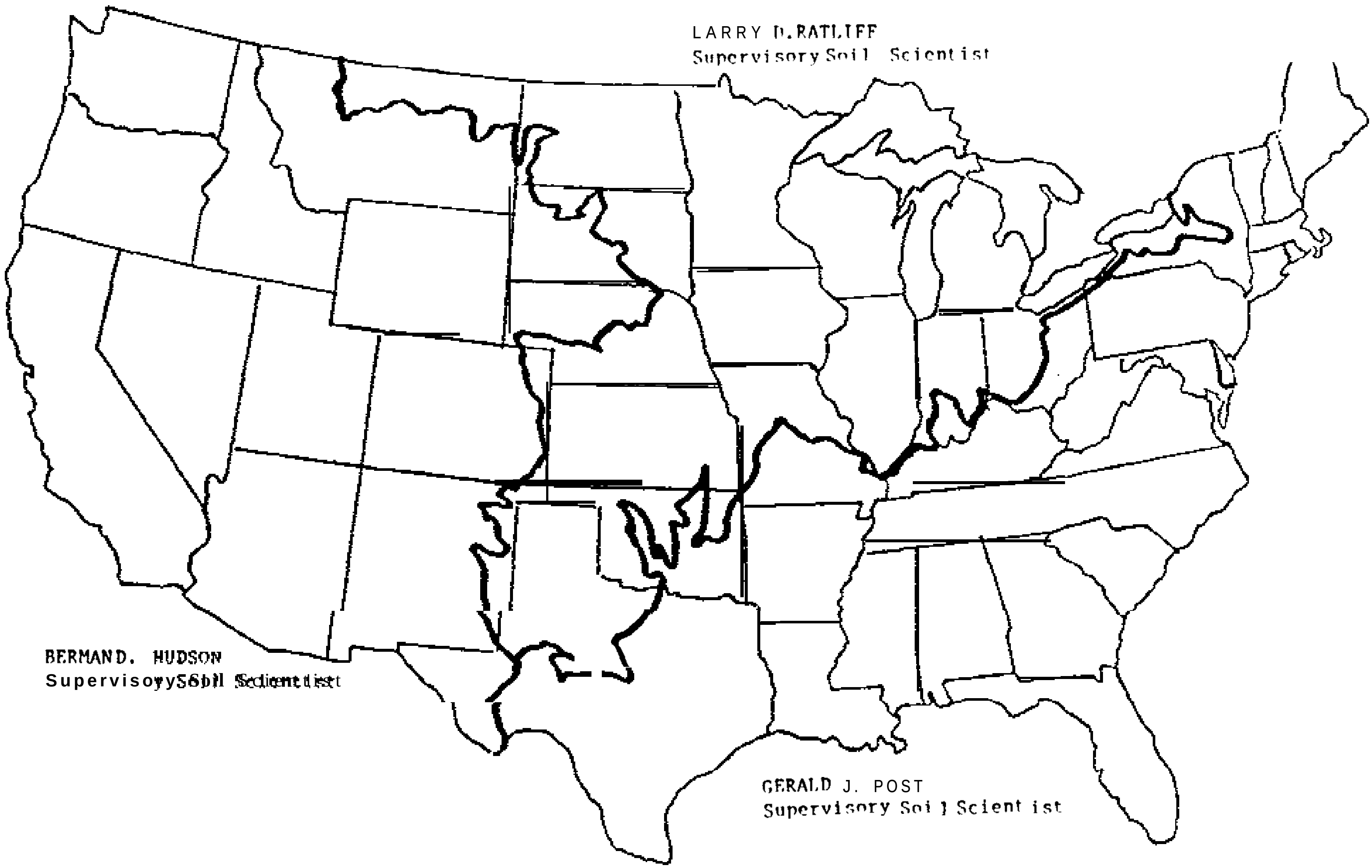
- Training during field reviews

- Training aids and modules

The emphasis is on progressive soil correlation. During each field review, the taxonomic units and map units recognized since the last review need to be reviewed and approved. Map compilation should keep current vith progressive correlation. Development of the soil survey manuscript should also keep pace with correlation.

The National Soil Survey Quality Assurance Staff will make its input early in the survey, beginning with a critical revicv of the memorandum of understanding. It is essential that staff members participate in the initial field review or an early progress review. It is anticipated that the came staff member will participate in the final field reviev and review the draft of the correlation that accompanies the reviev report. If the state does an adequate job of legend development and progressive correlation, the final field reviev can be held AS much as 1 year before the completion of mapping. A draft of the correlation is to be prepared by the state at the final field revicv. This draft is circulated for review by cooperators and the National SSQA Staff. When mapping is complete, the final correlation document is prepared and approved by the state soil scientist.

# SOIL SURVEY QUALITY ASSURANCE



REPORT ON MAP FINISH CONTRACTING

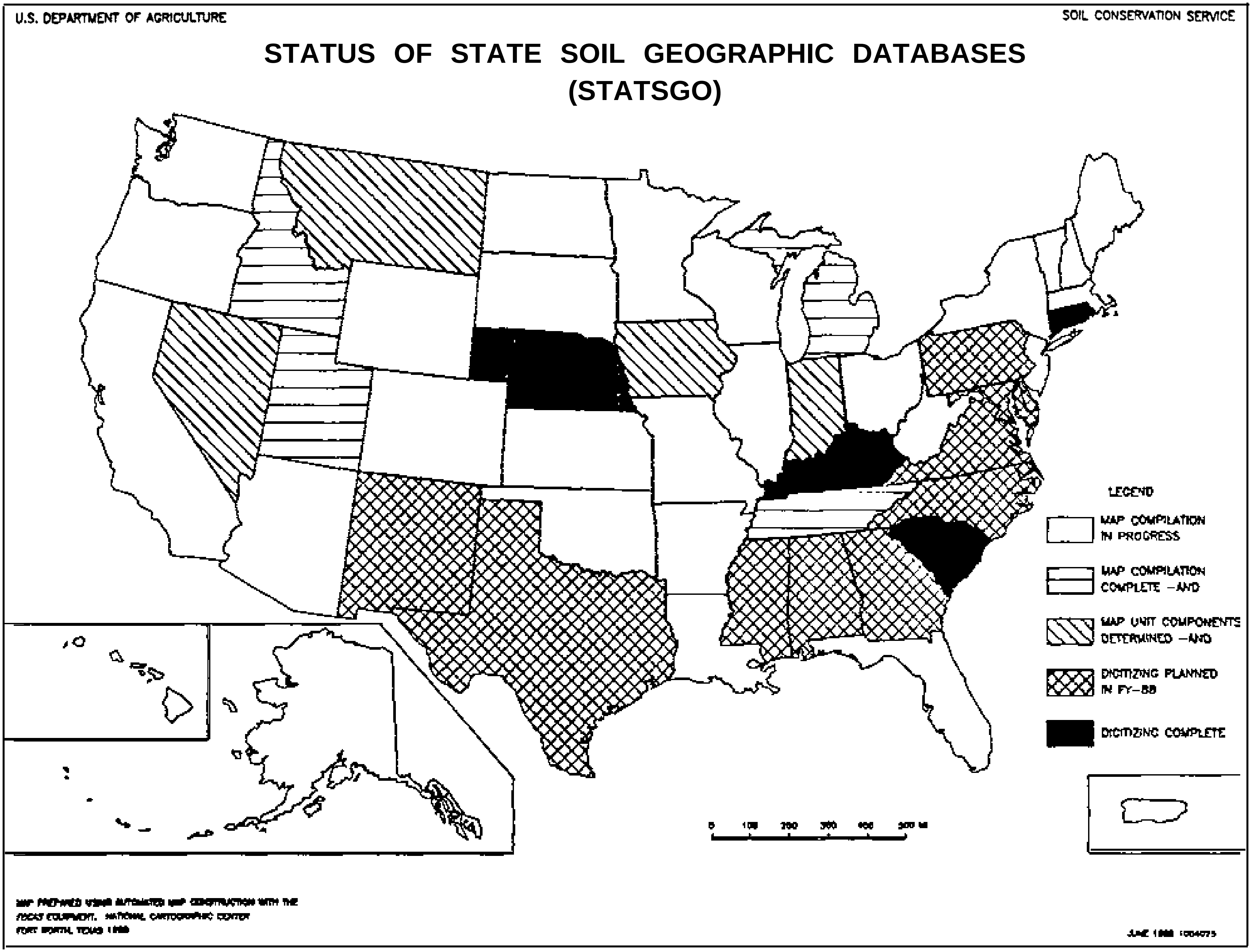
NATIONAL CARTOGRAPHIC CENTER

FORT WORTH, TEXAS

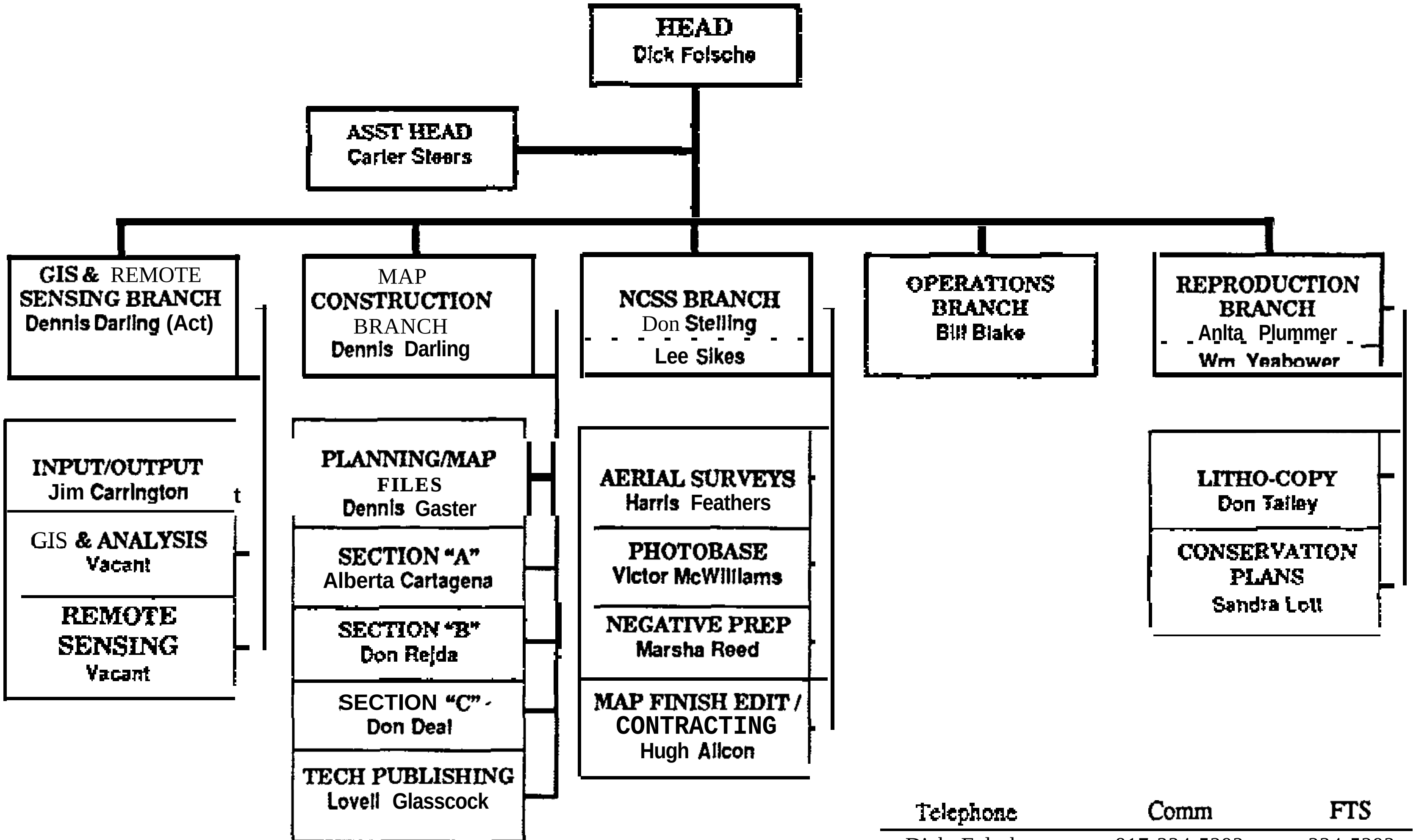
**Carter Steers**

This report describes work that has been performed by the National Cartographic Center since June 1985, for NCSS map finish scribing. Seventeen states have participated in contracting for map finishing services through the NCC. Fifty-two survey areas have been contracted totaling 2,684 map sheets of which 407 of the map sheets were full quad format. Total contract cost for these 52 surveys is $355,929.58 or an average of $6,844.72 per survey area. The average for map sheet is $132.61. The cost range is $53.44 per map sheet to as much as $529.37 per map sheet. The higher price range was for highly detailed soils and culture on a full quad format.

Most of the compilation received from the states is quite adequate for contract map finishing. Some is very well done, while others are poorly done and/or contain excessive errors. We can usually correct errors, missing symbols, soil lines, etc. by referring to the field sheets. However, poor quality work cannot be corrected efficiently. The poor quality compilation usually produces poorer quality maps at a higher cost. We pay contractors $2.00 each for authors errors. Authors errors are errors that are the responsibility of SCS.


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STATUS OF STATE SOIL GEOGRAPHIC DATABASES
(STATSGO)
LEGEND
MAP COMPILATION IN PROGRESS
MAP COMPILATION COMPLETE –AND
MAP UNIT COMPONENTS DETERMINED –AND
DIGITIZING PLANNED IN FY–88
DIGITIZING COMPLETE
0

# National Cartographic Center

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| Don Stelling | 817-334-5292 | 334-5292 |
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Mailing Address:
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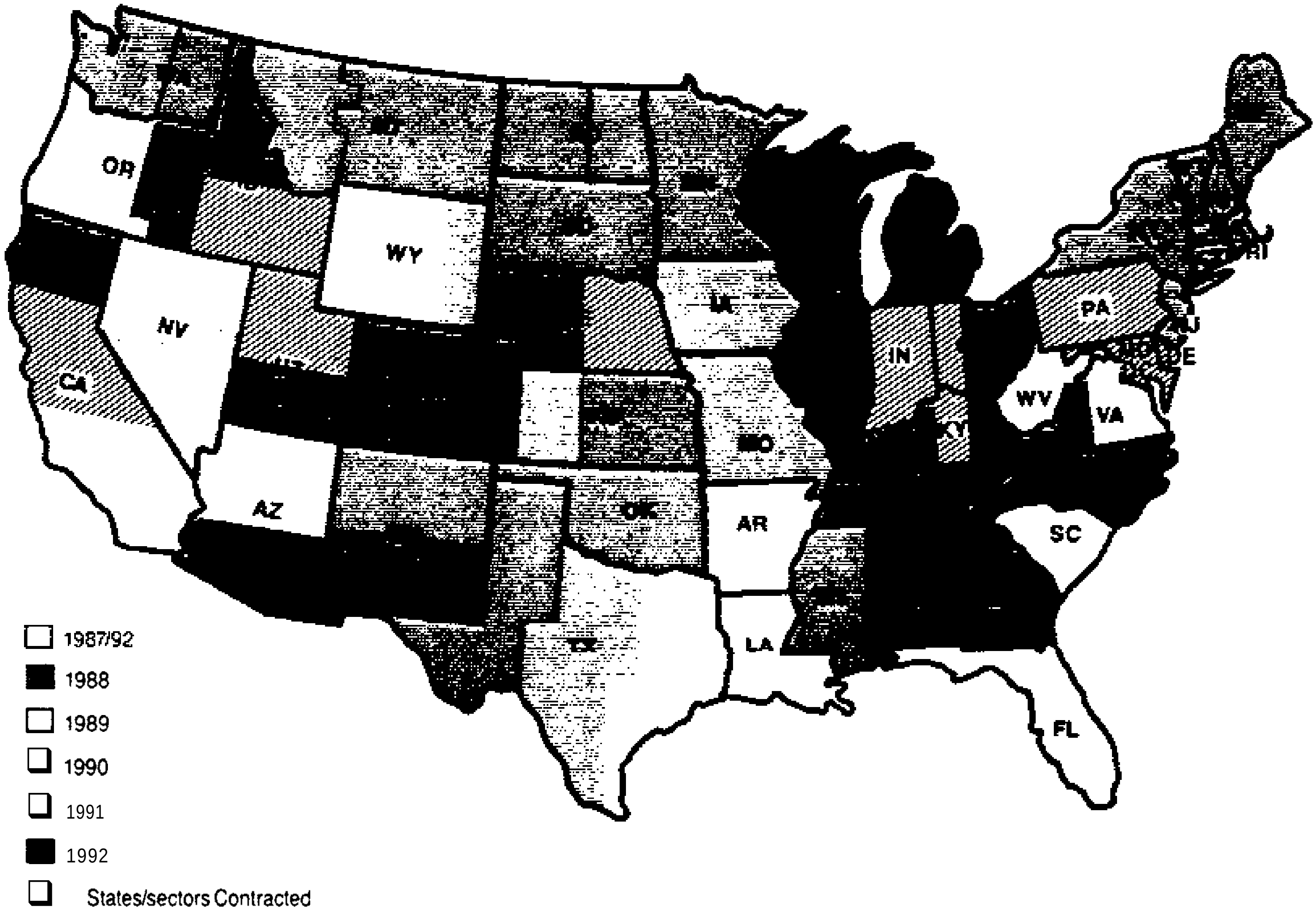
Fort Worth Federal Center
501 Felix St., P.O. Box 6567
Fort Worth, TX 76115

May 1988

# MULTI-YEAR NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP) ACQUISITION PLAN




SEPTEMBER 1987

4-SCS-NATIONAL CARTOGRAPHIC CENTER, FT WORTH, TX.-1989

Report to Southern Region Soil Survey Work Planning Conference
Knoxville, TN, June 13-17, 1988

From: National Soil Survey Laboratory

Presented by: Warren Lynn Monday, June 13, 1988 at 2:00 p.m.

National Soil Survey Center (NSSC)
The SCS is in the process of establishing a National Soil Survey Center within its Midwest National Technical Center in Lincoln, Nebraska. Steve Holzhey has taken the position of Assistant Director of the MNTC; the position relates directly to the NSSC. The National Soil Survey Laboratory (NSSL) is part of that center. We are in the midst of meshing our activities with those of other staffs in the NSSC. This includes the handling of liaison relations with states and with NTC (interpretations staffs).

NSSL - People
Ron Yeck is Acting Head of NSSL. Since the last work planning conference (1986), two soil scientists have been added to the professional staff: Terry Sobecki who was a graduate student at the University of Kentucky, and Tom Reinsch who was with the SCS in Oklahoma. Also, since the last work planning conference (1986), NSSL has reassigned liaison responsibilities to states. Benny Brasher serves as liaison to Arkansas, Louisiana, Oklahoma, and Texas. Warren Lynn remains as liaison to Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Puerto Rico, South Carolina, and Tennessee in the South Region.

Water Erosion Prediction Proaram (WEPP)
NSSL staff have been involved in sampling a number of WEPP sites since early 1987, both in cropland and in rangeland. Sites sampled in the South are in Georgia (Cecil, Cecil eroded, Hiwassee, Tiftion, and Bonifay), Mississippi (Grenada), North Carolina (Gaston), Oklahoma (Carey, Grant, and Grant eroded), and Texas (Amarillo, Heiden, and Pervis). Laboratory data are to be in the hands of ARS by January 1989.

International Taxonomv Committees
Laboratory people are involved in a number of committees:

ICOMID (Aridisols) - Tour in Southwest USA, Lubbock, Texas, to Riverside, California, in October 1987.

ICOMOD (Spodosols) - Tour scheduled for October, 1988 in the Northeastern USA and Eastern Canada.

ICOMAQ (Aquic soil moisture regimes) - Sampling is scheduled in September, 1988 to provide data for a tour to be held in October, 1990 just prior to the ASA meetings in San Antonio, Texas.

Investigations Activities in South
For FY 1987

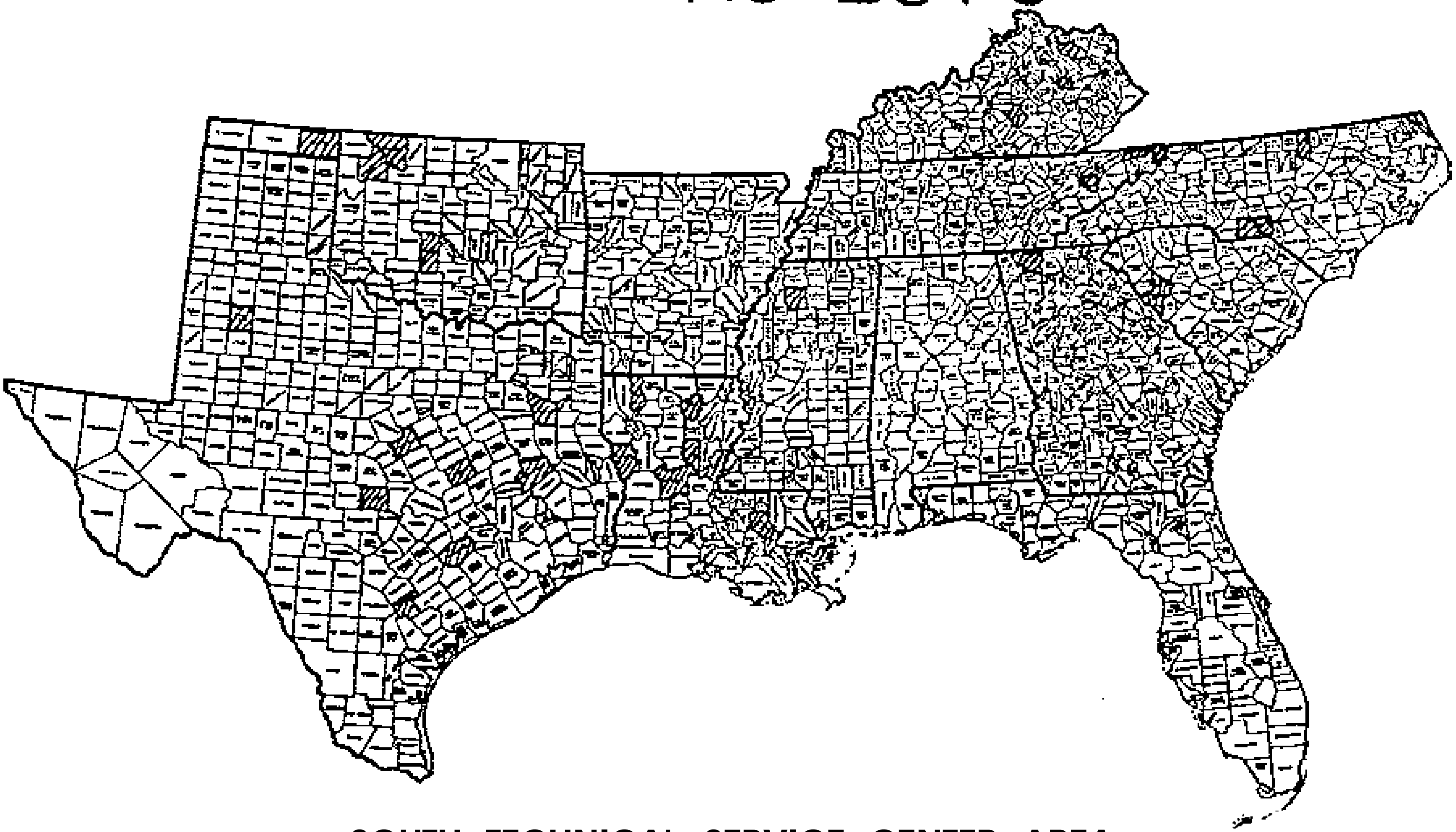
| | All Projects | | Characterization Projects | |
|---|---|---|---|---|
| | NSSL | South (%) | NSSL | South (%) |
| Projects | 265 | 23 (12%) | 91 | 22 (24%) |
| Pedons | 908 | 138 (15%) | 586 | 129 (22%) |
| Samples | 7340 | 922 (13%) | 3402 | 856 (25%) |
| Analyses | 156,541 | | | |

Attached are:

1. Map of South region indicating NSSL projects in FY 1987
2. Map of South region indicating NSSL projects in FY 1988
3. Excerpts from FY 1987 Annual Report for NSSL including

    a. Summaries of projects, pedons, and samples received for FY 1985, 1986, and 1987.
    b. Numbers of each analysis completed in FY 1985, 1986, and 1987.
    c. Analytical precision for FY 1987.
    d. Fee schedule (reimbursible work) as of 1/88.
    e. Distribution of data for FY 1987.

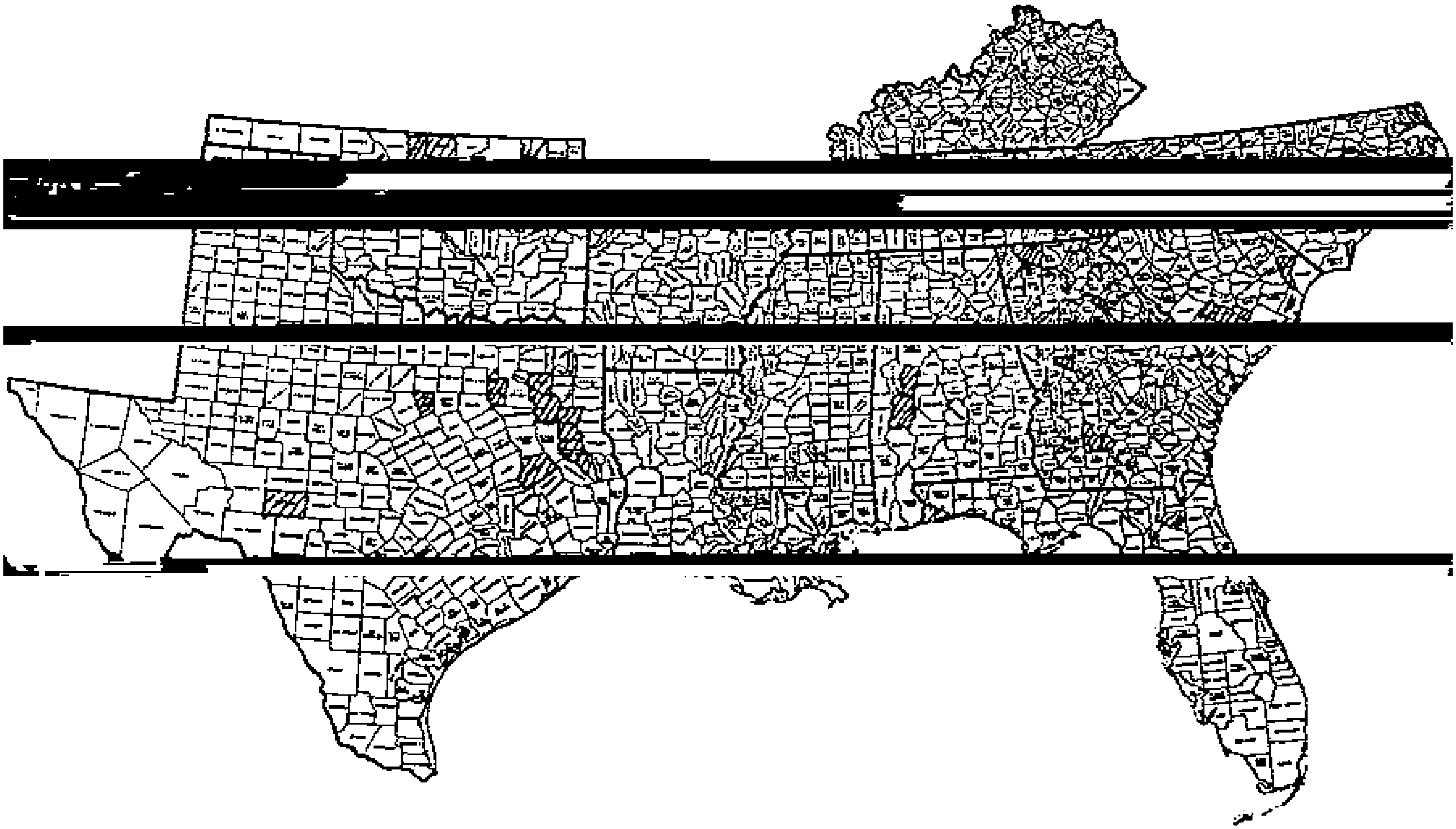
# NSSL FY1987 PROJECTS



**SOUTH TECHNICAL SERVICE CENTER AREA**
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

5,N-35,989

# NSSL FY1988 PROJECTS



**SOUTH TECHNICAL SERVICE CENTER AREA**
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

5,N-35,989

ANNUAL REPORT

ANALYTICAL STAFF

FY 1987

PROJECT WORK

EXCERPTS

NATIONAL SOIL SURVEY LABORATORY
MIDWEST NATIONAL TECHNICAL CENTER
SOIL CONSERVATION SERVICE, USDA
LINCOLN, NEBRASKA

OCTOBER 1987

| | FY 1985 | FY 1986 | FY 1987 |
|---|---|---|---|
| **Projects Received** | | | |
| Characterization | 287 | 263 | 265 |
| **Samples Received** | | | |
| Characterization | 9,165 | 9,656 | 7,340 |
| National Soil Moisture | 892 | 1.325 | 173 |
| Total | 10,057 | 10,981 | 7,513 |
| **Analyses Completed** | | | |
| Characterization | 168,838 | 147,593 | 156,368 |
| National Soil Moisture | 944 | 1,333 | 173 |
| Total | 169,782 | 148,926 | 156,541 |

## 2.2 CHARACTERIZATION VS. REFERENCE SAMPLES RECEIVED

| Kind | Projects No. | Projects Pct. | Pedons No. | Pedons Pct. | Samples No. | Samples Pct. | Samples Per Pedon |
|---|---|---|---|---|---|---|---|
| | | | FY 1987 | | | | |
| Caracterization | 91 | 34 | 587 | 57 | 3,397 | 46 | 5.8 |
| Reference | 174 | 66 | 451 | 43 | 3,943 | 54 | 4.9* |
| Total | 265 | | 1,038 | | 7,340 | | |
| | | | FY 1986 | | | | |
| Characterization | 78 | 30 | 565 | 50 | 3,493 | 36 | 6.2 |
| Reference | 185 | 70 | 564 | 50 | 6,163 | 64 | 5.7* |
| Total | 263 | | 1,129 | | 9,656 | | |
| | | | FY 1985 | | | | |
| Characterization | 63 | 22 | 458 | 34 | 2,710 | 30 | 5.9 |
| Reference | 224 | 78 | 625 | 66 | 6,455 | 70 | 5.0* |
| Total | 287 | | 1,083 | | 9,165 | | |

*Samples per pedon for projects (RP) that have data ly stored.

| | | | |
|---|---|---|---|
| Samples Prepared | | | |
| Regular | 9044 | 8873 | 8492 |
| Moisture Content | 5049 | 5158 | 4836 |
| Coarse Fragments | 4453 | 4351 | 4986 |
| Liquid Limit | 181 | 1137 | 304 |
| Plastic Limit | 181 | 1132 | 309 |
| Particle Size | 5741 | 5477 | 5354 |
| Fine Clay | 1774 | 1316 | 1159 |
| Clay Size Carbonate | 1292 | 148 | 1806 |
| Air Dry Moisture | 5510 | 4958 | 5609 |
| Bulk Density | | | |
| Field State | 6 | --- | 14 |
| 1/3-Bar | 1957 | 1951 | 3110 |
| Oven Dry | 1957 | 1951 | 2193 |
| Water Retention | | | |
| Field State | 2837 | 3985 | 1838 |
| 0.06-Bar | 179 | 17 | 16 |
| 0.10-Bar | 166 | 417 | 112 |
| 0.33-Bar | 1957 | 1951 | 2128 |
| 1-Bar | 174 | 74 | --- |
| 2-Bar | 414 | 385 | 809 |
| 15-Bar | 6473 | 5866 | 6370 |
| Histosol | | | |
| Water Content | --- | --- | --- |
| Ash | 39 | 13 | 53 |
| pH | --- | 45 | 36 |
| Unrubbed Fiber | 12 | 15 | 16 |
| Rubbed Fiber | 17 | 15 | 74 |
| Sodium Pyrophosphate Color | 74 | 15 | 24 |
| Clay Mineralogy | | | |
| X-ray Diffraction | 1340 | 1104 | 1760 |
| Differential Thermal Analysis | 2451 | 811 | --- |
| Differential Scanning Calorimeter | --- | 522 | 1388 |
| Thermal Gravimetric Analysis | --- | 34 | 327 |
| Sand and Silty Mineralogy | | | |
| Grain Count (optical) | 498 | 712 | 879 |
| X-ray Diffraction | 61 | 193 | 354 |
| Thin Sections | 352 | 450 | 387 |
| Cation Exchange Capacity | | | |
| $NH_4OAc$ | 4090 | 1349 | 3356 |
| $NH_4Cl$ | 297 | --- | --- |
| Extractable Bases | | | |
| Calcium | 4658 | 3376 | 3409 |
| Magnesium | 4657 | 3358 | 3404 |
| Sodium | 4646 | 3358 | 3395 |
| Potassium | 4646 | 3358 | 3417 |
| Extractable Acidity | 2701 | 2714 | 2970 |
| Extractable Aluminum | 2589 | 1173 | 774 |
| Extractable Manganese | --- | 1340 | 798 |
| Fiber Surface Area | 795 | 379 | --- |

| | | | |
|---|---|---|---|
| Citrate/Dithionite Extraction | | | |
| Iron | 3183 | 3347 | 3260 |
| Aluminum | 2924 | 3221 | 2113 |
| Manganese | 1939 | 1378 | 413 |
| Pyrophosphate Extraction | | | |
| Iron | 944 | 800 | 335 |
| Aluminum | 893 | 440 | 301 |
| Total Analysis (HF) | | | |
| Potassium | 1434 | 1056 | 944 |
| Iron | 1530 | 1056 | 944 |
| Aluminum | 96 | 50 | --- |
| Organic Carbon | 7056 | 4294 | 4835 |
| Total Carbon | 1308 | 1052 | 848 |
| Nitrogen | 2734 | 1359 | 1514 |
| Saturated Paste/Saturated Extract | | | |
| Percent Saturation | 963 | 838 | 1301 |
| pH (paste) | 956 | 844 | 1318 |
| Resistivity (paste) | 336 | 765 | 320 |
| Electrical Conductivity | 919 | 735 | 1175 |
| Calcium | 940 | 855 | 1408 |
| Magnesium | 940 | 851 | 1381 |
| Sodium | 968 | 858 | 1448 |
| Potassium | 968 | 851 | 1368 |
| Carbonate | 838 | 720 | 1140 |
| Bicarbonate | 838 | 720 | 1240 |
| Chloride | 856 | 846 | 1276 |
| Sulfate | 856 | 845 | 1276 |
| Nitrate | 856 | 833 | 1276 |
| Fluoride | 854 | 846 | 1276 |
| $NO_3$ | --- | 846 | 1276 |
| Electrical Conductivity 1:2 Soil Water Ratio | 1065 | 1566 | 1964 |
| Gypsum | 3166 | 403 | 423 |
| pH | | | |
| 1:1 Water | 6303 | 5133 | 4460 |
| 1:2 0.01M Calcium Chloride | 6150 | 5119 | 4060 |
| 1:1 N KCl | 716 | 826 | 737 |
| NaF | 533 | 442 | 361 |
| Calcium Carbonate Equivalent | 1947 | 1899 | 3510 |
| Sulfur | 133 | 31 | 38 |
| Phosphorous Retention (N.Z.) | 300 | 446 | 474 |
| Phosphorous (Bray 1) | 273 | 380 | 133 |
| Sulfate - EPA | 3463 | --- | --- |
| Heavy Metals and Trace Elements--ICP | | 606 | 1766 |
| Other Analysis | 7260 | 4106 | 593 |
| Duplicates and Standards | 38753 | 33458 | 25089 |
| Blanks | (12641) | (13089) | (17753) |
| TOTAL (Excluding Blanks) | 149183 | 148925 | 138581 |

## 3.2 ANALYTICAL PRECISION

| Analytical Measurement | Method | Observations | Mean $\bar{X}$ | Std. Dev. S | C.V. |
|---|---|---|---|---|---|
| **Anions - Sat. Extract** | | | | | |
| Cl | 6K1c | 14 | 68.3 | 6.6 | 9.6 |
| $NO_3$ | 6M1c | 14 | 21.3 | 2.4 | 11.2 |
| $SO_4$ | 6L1c | 14 | 54.3 | 4.1 | 7.5 |
| $HCO_3$ | 6J1c | 14 | 4.4 | .8 | 17.7 |
| **Cations - Sat. Extract** | | | | | |
| $Ca-H_2O$ | 6N1b | 14 | 41.5 | 1.1 | 2.8 |
| $Mg-H_2O$ | 6O1b | 14 | 9.6 | .24 | 2.6 |
| $Na-H_2O$ | 6P1b | 14 | 99.6 | 2.7 | 2.7 |
| $K-H_2O$ | 6Q1b | 14 | .68 | .04 | 6.3 |
| $H_2O$% | 8a | 14 | 42.7 | .90 | 2.1 |
| Paste pH | 8C1b | 14 | 7.3 | .07 | 1.0 |
| E.C. | 8A3a | 14 | 12.3 | .49 | 4.0 |
| **Cations** | | | | | |
| Al-C/D | 6G7a | 33 | .74 | .01 | 5.4 |
| Al-KCl | 6G9a | 21 | 3.1 | .18 | 5.7 |
| Al-Pyro | 6G10a | 10 | .97 | .06 | 6.3 |
| $Ca-NH_4OAc$ | 6N2e | 83 | 19.1 | 1.88 | 9.8 |
| Fe-C/D | 6C2b | 35 | 2.5 | .05 | 2.2 |
| Fe-Pyro | 6C8a | 10 | .55 | .04 | 8.2 |
| Fe-HF | 7C3 | 30 | 2.6 | .125 | 3.4 |
| $K-NH_4OAc$ | 6Q2b | 83 | 2.1 | .12 | 5.6 |
| $K_2O-HF$ | 7C3 | 30 | 2.4 | .083 | 4.9 |
| $Mg-NH_4OAc$ | 6O2d | 83 | 7.4 | .36 | 4.9 |
| Mn-C/D | 6D2a | 19 | .01 | -- | -- |
| $Na-NH_4OAc$ | 6P2b | 83 | .04 | .05 | -- |
| **Calcium Carbonate Equiv.** | 6E1g | 22 | 7.4 | .42 | 5.7 |
| **Cation Exchange Capacity** | | | | | |
| $NH_4OAc$ | 5A8c | 83 | 27.1 | .36 | 1.8 |
| **Extractable Acidity** | 6H5a | 76 | 3.9 | .39 | 10.2 |
| **Nitrogen** | 6B3a | 105 | .143 | .004 | 2.7 |

| Analytical Measurement | Method | Observations | Mean $\bar{X}$ | Std. Dev. S | C.V. |
|---|---|---|---|---|---|
| **Organic Carbon** | 6A1c | 251 | 1.47 | .025 | 1.7 |
| **Total Carbon** | | | | | |
| [redacted] | | | | | |
| NaF | 8C1d | 22 | 11.0 | .09 | .8 |
| KCl | 8C1g | 35 | 4.1 | .03 | .8 |
| **Phosphorous - Bray 1** | 6S3 | 6 | 2.78 | .19 | 7.0 |
| **Phosphorous Retention (NZ)** | 6S4 | 8 | 33.3 | 3.8 | 11.3 |
| **Gypsum** | 6F1a | 38 | 12.4 | .70 | 5.7 |
| **Clay Mineralogy** | | | | | |
| Gibbsite - TGA | 7A4b | 8 | 1.30 | .083 | 6 |
| Kaolinite - TGA | 7A4b | 8 | 1.22 | .089 | 7 |
| Gibbsite - DSC | 7A6 | 62 | 3.8 | .656 | 17 |
| Kaolinite - DSC | 7A6 | 59 | 12.7 | 3.45 | 27 |
| **Particle Size** | | | | | |
| Clay - <.0002mm | 3A1b | 23 | 9.8 | .72 | 7.4 |
| Clay - <.002mm | 3A1 | 118 | 33.7 | .64 | 1.9 |
| Silt - .002-.05mm | 3A1 | 118 | 56.8 | .89 | 1.6 |
| Sand - .05-2mm | 3A1 | 118 | 9.5 | .89 | 9.4 |
| $CO_3$ clay - <.002mm | 3A1a | 84 | 5.4 | .81 | 14.9 |
| **Water Retention** | | | | | |
| 15-bar | 4B2 | 181 | 11.6 | .35 | 3.0 |
| 2-bar | 4B1 | 69 | 17.6 | .55 | 3.1 |
| 1-bar | 4B1 | 2 | 21.1 | .64 | 3.1 |
| 0.33-bar | 4B1 | 251 | 31.8 | .92 | 2.9 |
| 0.1-bar | 4B1 | 9 | 35.8 | .96 | 2.7 |
| 0.06-bar | 4B1 | 5 | 36.8 | 1.03 | 2.8 |

USDA, SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
FEDERAL BUILDING, ROOM 345
100 CENTENNIAL MALL NORTH
LINCOLN, NEBRASKA 68508-3866

SAMPLE FEE SCHEDULE (1/88)

| | |
|---|---|
| Sample Preparation | |
| Receiving and preparation | 6.00 |
| Coarse fragments | 3.00 |
| Regulated | 2.00 |
| Moist sieve | 4.50 |
| Particle size Analysis | 22.00 |
| Fine clay | 6.00 |
| Carbonate clay | 3.00 |
| Atterberg Limits | 14.00 |
| Clod bulk density, 1/3 bar, COLE | 30.00 |
| Core bulk density | 5.00 |
| Water retension (< 2 mm) | 3.00 |
| Gravimetric | 1.50 |
| Histosol Analyses | 28.00 |
| Clay Mineralogy ($K_2O$ and $Fe_2O_3$) | 16.00 |
| x-ray | 45.00 |
| DSC | 25.00 |
| TGA | 25.00 |
| Optical Mineralogy | 25.00 |
| Micromorphology | 35.00 |
| Cation Exchange Capacity plus Bases | 25.00 |
| Extractable Acidity | 5.00 |
| Extractable Aluminum | 7.00 |
| Citrate-Dithionite Extractable Fe, Al, Mn | 15.00 |
| Acid Oxalate Extractable Fe. Al, Si | 15.00 |
| Pyrophosphate Extractable Fe, Al | 11.00 |
| Organic Carbon | 3.50 |

| | |
|---|---|
| Total Nitrogen | 6.50 |
| Total Carbon | 3.00 |
| Total Sulfur | 8.00 |
| pH - 1:1 water 6 | 3.00 |
| - 1:1 KCl | 3.00 |
| - NaF | 3.50 |
| Calcium Carbonate Equivalent | 3.50 |
| Saturated Paste - Saturated Extract Analyses | 56.00 |
| sodium Adsorption Ratio (SAR) | 25.00 |
| Electrical Conductivity (1:2 extract) | 5.00 |
| Gypsum | 9.50 |
| Phosphorous (Bray 1) | 9.50 |
| Phosphorous Retention (N.Z.) | 5.00 |
| EGME Surface Area | 14.50 |

Distribution of Data for FY 1987

5.1 Final distribution for completed projects

| REGION | CP | RP | RT | QS | TOTAL |
|---|---|---|---|---|---|
| | PROJECTS | | | | |
| FOREIGN | 3 | -- | 4 | __ | 7 |
| MIDWEST | 12 | 40 | 13 | 14 | 80 |
| NORTHEAST | 4 | 2 | 2 | 1 | 9 |
| SOUTH | 28 | 7 | 4 | 6 | 45 |
| WEST | 15 | 23 | 12 | 2 | 52 |
| MISCELLANEOUS | 2 | 2 | 2 | 24 | 30 |
| TOTAL | 65 | 74 | 37 | 4-i | 223 |

Distribution of data for partially completed projects

| REGION | CP | RP | RT | QS | TOTAL |
|---|---|---|---|---|---|
| | PROJECTS | | | | |
| FOREIGN | 4 | -- | -- | __ | 4 |
| MIDWEST | 4 | 5 | __ | __ | 9 |
| NORTHEAST | 5 | __ | 2 | __ | 7 |
| SOUTH | 11 | 2 | -- | -- | 13 |
| WEST | 15 | 3 | 2 | -- | 20 |
| MISCELLANEOUS | -- | -- | -- | -- | __ |
| TOTAL | 39 | 10 | 4 | -- | 53 |

C = Characterization Project
R = Reference Project (Partial Characterization)
P = Permanent Data Storage
T = Temporary Data Storage
Q = Data Not Stored

## COMMITTEES AND CHARGES
## FOR
## 1988 NORTH CENTRAL SOIL SURVEY CONFERENCE

James R. Culver

COMMITTEE 1 - Development and Coordination of Soil Survey Data Bases, Chairman - James Crum, Michigan

Charge 1 - What kinds of soil survey data bases will we need for mapping unit interpretation to support the long-range soil survey program beyond 1990? Consider the vast amount of soil fertility data and engineering test data available in state and private laboratories. Should some of this data be part of the soil survey data base?

Charge 2 - How should the soil survey data be stored and retrieved? Is there a need for state soil survey data bases to have a uniform formatted central core of data that can readily be accessed by adjacent states using the same soil series?

Charge 3 - Identify ways that encourage or enhance the exchange of data base information among NCSS cooperators.

Charge 4 - Identify the academic needs in computer science and related courses at the undergraduate and graduate level for students who wish to pursue a career as a professional soil scientist in our modern day technology. Goal is to provide guidance for curriculum and counseling of students.

COMMITTEE 2 - Soil Interpretations, Chairman - Keith Huffman

Charge 1 - Discuss the soil property data that should be used in modeling (i.e., average, modal, a range). Where should the data come from (i.e., laboratory data, soil interpretation records, research)? Uhat should the number used in modeling represent?

Charge 2 - The principles and techniques of making soil potentials Is well documented; however, use is limited. Identify how to enhance effective use of soil potentials. Yhat degree and involvement and documentation is needed?

Charge 3 - How can soil survey data be related to water quality? Reliable soil pedon data extends to a depth of about two meters. How do we relate this data to the often much thicker geological material in evaluation of nitrate movement and other contaminates to groundwater?

Charge 4 - Discuss the academic training needed for making soil interpretations by students who become soil scientists. Relate the need for basic science (i.e., math, chemistry, physics, engineering) in providing a technical background to make quality soil interpretations.

COMMITTEE 3 - Soil-Water Relationships, Chairman - Otto **Baumer,** Lincoln

Charge **1** - Review the International Committee reconsnendations on soil moisture criteria and evaluate the impact on classification and **interpretation** of soils in the Midwest. Make **recommendations** to **ICOMAQ.**

Charge 2 - Discuss the applicability and acceptability of **using** the **soil-**water states as given In the National Soils **Handbook** In **field** operations and soil survey publications.

COMMITTEE 4 - New Packaging of Our Information, Chairman - Randy Hilts, Missouri.

Charge 1 - Indicate major areas of interpretation needs and data needs for the next 10 years.

Charge 2 - Examine current trends and future needs In dissemination of soil survey information to users.

Charge 3 - Discuss the alternatives of packaging the soil maps and Interpretations for modernizing older soil surveys. What kind of soil maps will the user need (i.e., aerial photography base, computer generated map)?

**COMMITTEE** 5 - **Soil Correlation** and **Classification,** Chairman - **Michael** Ransom, **Kansas.**

Charge 1 - Consider proposed revisions for mineralogy classes in Soil Taxonomy. Consider revisions proposed for definitions of the control section for determination of the particle size classes. Respond to Issues raised by the National Task Force on Soil Family Category that was part of **the** 1987 National Soil Survey Conference.

Charge 2 - Reach a consensus as to the continued use of variants in soil correlation.

Charge 3 - Develop guidelines for application In establishing the geographic range of **soilseries.** Develop **guidelines** on when to establish new series as a result of items such as changes In soil moisture or soil temperature. When should a taxadjunct be used? When should the geographic range of **a** series be extended?

Charge 4 - Develop minimum soil correlation and classification rtqutrtmtnts for modernizing old soil surveys. Discuss any need for a greater amount of transect data, ptdon descriptions and laboratory data in field mapping of modernizing soil surveys as compared to the information needed for present soil correlation. How do we utilize older data in soil correlation updates?

COMMITTEE 6 - Landscape Analysis and develoogment of map units.
Chairman - Ken Olsen - Illinois

Charge 1 - Discuss landscape components of map units (consociations, complexes, association, undifferentiated) as they relate to making soil Interpretations and for geographic Information systems. Give priority to effect of landscape components on erosion relationships, crop productivity, hydrology, and wetland assessment.

Charge 2 - Develop guidelines for describing the landscape characteristics of map units at various scales. Include terminology, illustrations and definitions of terms for use in soil nap unit descriptions.

Charge 3 - Discuss the impact of landscape analysis used in models such as the Water Erosion Predictton Project (WEPP). Relate Items such as length and shape of slope, erosion and accumulation or deposition of sediments to WEPP. Can we develop information for map units that will satisfy the needs of WEPP?

Charge 4 - *Illustrate* how map units based on landscapes might be interpreted for different purposes. This will enable others to better comprehend who the audiences might be and Indicate some of the ways in which the information can be used.

## QUESTIONNAIRE
## Proposed NCSS Laboratory Database
## 1999 Regional Work Planning Conferences

Benny R. Brasher

During the week of July 25-29, a NCSS Committee will meet in Lincoln, NE, to consider the content of a proposed NCSS database to be known as the National Soil Characterization Database. The committee will consist of four AES representatives, to be selected during the four regional NCSS work planning conferences, and 3-4 SCS representatives. Some of the purposes of this questionnaire are to solicit opinions on what you think the database should contain other than what is included in the usual laboratory characterization measurements and site and profile descriptions; to determine the most frequently requested soils information; and to get your input on operational guidelines for the database. The questionnaire answers will be tabulated for consideration during the July NCSS Committee meeting.

• * * * * * * * * *

1. Are you in favor of a National Soil Characterization Database (NSCDB)? If not, please give your reasons?

2. Who would be the major users of a NSCDB in your area?

| Today | In 10 Years |
|---|---|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |

3. Would your agency or department look favorably on contributions of your time and/or budget to support a NSCDB?

Yes

No

4. Who should house, maintain and operate a NSCDB? University, SCS, private contractor, other? Briefly state you reasons.

5. List the most frequent kinds of requests for soils information that you have had during the last year.

Agricultural:

1.

2.

3.

Nonagricultural:

1.

2.

3.

6. List the most frequent kinds of requests for soils information that you could not fulfill because that information is usually not collected.

Agricultural:

1.

2.

3.

Nonagricultural:

1.

2.

3.

7. Have you received requests that require statistical treatment or sorting and sumarizing large bodies of data. If yes, give examples.

No

Yes

1.

2.

3.

8. In descending order list the **frequency** of requests for physical, chemical, and mineralogical data.

1.

2.

3.

9. 6hould special studies such as the SCS National Soil Moisture and Heavy **Metals** studies be a part of the NSCDB or should they be made available by the facility that did the work?

10. Should soil fertility data obtained by **"standard"** laboratory methods be in the NSCDB? How about fertility and any other data obtained by experimental or modified **"standard"** methods?

11. A good profile description and a thorough writeup **of** methodology or reference citations would seem to be minimum criteria for accepting data for the NSCDB. What should be the minimum number of:

Horizons?

Major determinations (PSDA, CEC, etc.,) per horizon?

32. Increasingly **modellers** need temporal information such as changes in the field moisture content and characteristics of Ap horizons (aggregation, roughness, bulk density, etc.,). **Assuming** that this kind of data will be or **is** being collected, should it be made available through the NSCDB? If not, then how?

13. Are you satisfied with the SCS computer program for describing soils? If not, then list changes you would like to have made:

**Landform -**

Site -

Pedon (features involving more than 1 horizon: Boulders, tree throw, etc.,) -

Horizon -

Other -

14. List other comments on the content or operation of a NSCDB. (Continue on back of page if needed).

**your name** ________________ affiliation: college, Ted. agency, other ________________

If you wish, you may **keep** the questionnaire and mail it later to:

Benny R. Brasher
Midwest National Technical Center-SCS
National Soil Survey Laboratory
Federal Building, Room 345
100 Centennial Mall North
Lincoln, NE 68508-3866
(402/437-5363)

## International Soil Classification Committee

Joe D. Nichols

This report on the International Soil Classification Committee is to bring you up to date on the committee work. In addition, I hope to encourage you to take part in the committee work. You become a member by sending comments to the chairman. The benefit is two-fold. First you get your knowledge and expertise into the system and second you benefit from reading comments from other soil scientists.

Committees:

1. ICOM on Low Activity Clay (ICOMLAC) chaired by F. Moormann. The work is complete and the results are in Soil Taxonomy.

2. ICOM on Oxisols (ICOMOX) chaired by Stanley Buol. The work is complete and the results are in Soil Taxonomy.

3. ICOM on Andisols (ICOMAND) chaired by M. Leamy. Circular Letter Number 10 is being circulated with comments due at the end of June. This is expected to be the last newsletter. The results will be a new order for Soil Taxonomy. A United States tour was held in 1986 and a tour to Japan in 1987.

4. ICOM on Moisture Regimes (ICOMMORT) chaired by A. Van Wambeke. Soil moisture regimes in the tropics. Several circular letters were circulated and several SMSS publications published on soil moisture in the early 80's.

5. ICOM on Aridisols (ICOMID) chaired by A. Osman. A tour in the U.S., from Lubbock, Texas to Riverside, California was held last October. A tour was held in Yemen, in January 1987. Major changes are proposed and will take some time to work out the problems.

6. ICOM on Vertisols (ICOMERT) chaired by J. Comerma. The first circular letter, April 1981. Dr. Comerma was on sabattical leave at Texas A&M from 1983-1984. He spent a year on several soils in the the U.S but no U.S. soil scientist saw all of them because of a severe travel fund shortage.

7. ICOM on Wet Soils (ICOMAQ) chaired by J. Bouma. Six circular letters were distributed. The results of this work are very

a.

SPOT IMAGERY FOR SOIL SURVEYS

R. H. Griffin, II

My first Work planning conference was in 197.4 at Jackson, MS. I wee with NASA at the time, we had launched ERTS-1 in 1972 and I talked about the use of satellite data in soil survey.

For a lot of reasons, far too numerous to mention here, this data has not been utilized to the extent that some of us felt that it should be primary reason being the resolution of the data. The individual cells were 56 meters by 79 meters (185 ft x 261 ft) or 1.2 acres. This seems small enough, but the resulting images did not have enough detail for soil survey.

I am back today with a new deal. The French launched a satellite in February 1986 with much better resolution. This satellite has 2 systems, (1) a single channel (band) system with a 10 meter (33 ft) resolution that provides a black and white image that appears very similar to a high altitude b/w photograph, (2) the other system has a 3 channel (hand) detector that provides and image very similar to a high altitude color IR photograph. This multi-band detector hae a 20 meter (66 ft) resolution. The normal period between data takes is 26 days. However, the detectors can be aimed making it possible to obtain data from a given area up to 11 times during a 26 day orbital cycle. The ability to change the view angle, also provides the ability to obtain stereo images.

I believe that this new satellite data can be an effective tool for use in soil survey. I will be glad to work with any of you to test and evaluate this data.

Included are sheets on the SPOT satellite characteristics, the SPOT data items available from SPOT and the prices of the data items. Also, included is a letter from Barringer Geoservices, a company that will take the SPOT data tapes and create 1:24,000 ortho-like images.

# SPOT CHECK
# SPOT 1 Satellite System Facts

- SPOT: Satellite Pour l'Observation de la Terre (Earth Observation Satellite)

- Launched on February 22, 1986. 8:44 p.m. (EST) from Kourou, French Guiana

- SPOT 1 dimensions

  Body - 2m x 2m x 4.7m

  Solar Panels - 15.6m

  Weight - 1806kg

- Orbit

  Sunsynchronous, near-polar

  Altitude - 832km

  Inclination - 98.7 degrees

  Orbital cycle - 26 days for complete Earth coverage

  Equatorial crossing - 10:30 AM mean local solar time

- Sensors

  Two high resolution visible (HRV) instruments

  Adjustable view angle - 27 degree range east and west of the orbital path

  Ground imaging swath - 60km/instrument, 117km (3km overlap) when combined (vertical viewing)

- Spectral resolution (wavelength bands)

| | | |
|---|---|---|
| Panchromatic | SO to .73 microns | |
| Multispectral | .50 to .59 microns | (green band) |
| | .61 to .68 microns | (red band) |
| | .79 to .89 microns | (near infrared band) |

(over)

*SPOT Image Corporation* *1897 Preston White Drive • Reston, VA 220914326 • (703)*

## Data Items Offered by SPOT Image Corporation

- Ground resolution (pixel size)

  Panchromatic 10m x 10m

  Multispectral 20m x 20m

- Satellite images available as:

  Computer-compatible tapes (CCT)

  Photographic prints

  Transparencies

- Standard single scene size:

  60km x 60km (vertical view angle)

  60km x 80km (maximum view angle: 27°)

- Scenes available at the following scales:

  1:100,000 1:250,000 1:400,000

- Processing levels for data items:

  Level 1A - raw image data with radiometric corrections to normalize detector response

  Level 1B - radiometric corrections and geometric corrections for viewing angle, systematic and orbital effects

  Level 2 - radiometric and geometric corrections - image presented at a specified cartographic projection

  Level s - radiometric and geometric corrections - multidate scenes registered to one another

*How to Obtain* ***SPOT Data***

*Fee Schedule*

*General Terms and Conditions Agreement*

SPOT
Image
Corporation

1897
Preston
White
Drive

Virginia
22091-4326

703/
620 2200
Telex
4993073

Dear Colleague,

I am pleased to provide you with general information designed to assist in obtaining SPOT Data. Our goal Is to provide you with quality data of any location in the world on a reliable basis. We have created a simplified procedure which should make it easy both to sign up as a SPOT user and to request and receive data quickly.

The first section of this package explains How *To Obtain SPOT Data*. The package also includes our Agreement on General *Terms* and *Conditions* and our current *SPOT Data* Fee *Schedule.*

**If you are prepared to sign up with SPOT, please read, sign and return the enclosed** Agreement on General *Terms and Conditions*. That will allow us to open a customer account and start working with you. Once we have received the signed Agreement. we will send you a supply of *License* Request and Catalog *Inquiry* forms and the *SPOT Grid Reference System Maps* of the United States and other parts of the world of interest to you.

Enclosed you will find a **postcard** which has **been** provided for your convenience to assist in maintaining our mailing list. In addition, if you are not yet ready to sign the Agreement but remain interested in SPOT Data licensing information, please let us know by checking the appropriate box and completing the postcard.

If you have any questions please contact:

**SPOT Image Corporation**
**1897 Preston White Drive**
**Reston, Virginia** 330914328
**Telephone: (703) 620-2200**

Again, your interest in SPOT is sincerely appreciated and we look forward to serving you.

Truly yours,

P. Bescond

Pierre Bescond
President

## How to Obtain SPOT Data

SPOT Image Corporation is the licensor in the United States of SPOT Data." imagery of the earths surface acquired by the SPOT satellites. This material describes the licensing procedures for uses which do not involve commercial reproduction or distribution of SPOT Data and related products. Persons interested in commercial reproduction or distribution of SPOT Data should consult with SPOT Image Corporation.

Users in the United States may obtain SPOT Data of any location (a SPOT scene) on the earth's surface through SPOT Image Corporation. SPOT Data maybe obtained in both computer compatible tape (CCT) and photographic media. Data are provided either from SPOT's archive of available scenes or are newly acquired through the programming of the SPOT satellite. SPOT Image Corporation makes data available through the issuance of user licenses for specific SPOT Data Items. These licenses permit the user very broad internal use of the data. Obtaining a license to use SPOT Data involves two steps:

(i) the prospective Licensee delivers to SPOT Image Corporation a signed copy of the *Agreement on General Terms and Conditions for SPOT Data User Licenses.* which will then govern each individual license; and

(ii) when specific *scenes* are desired. the Licensee submits a *License Request* form to SPOT Image Corporation identifying the desired *scenes* and media and pays the appropriate license fee.

The SPOT Image Corporation *Fee Schedule* provides the current fees and available discounts for specific SPOT Data Items. The *SPOT Data Items and Options* document defines the standard specifications and nonstandard options available for SPOT Data Items.

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Who May Be A Licensee The license granted by SPOT Image Corporation permits the Licensee to make internal use of the SPOT Data without any limitation as to purpose. It is important, in order to ensure that all users are protected and treated equally. that the Licensee be defined so that a number of distinct users do not obtain rightsunder a single license. For this reason, in thecaseof organizations, the Licensee should be only an organization or organizational component which will make use of SPOT Data in its distinct business activity

SPOT Image Corporation reserves the right to deny a license request in which the proposed Licensee consists of several distinct users. SPOT Image Corporation will discuss necessary arrangements for special circumstances.

A Licensee can be an individual, a company, a government entity or a member of a joint venture.

Although it is not possibletogiveanydefinitiverulesabout thedefinitionofthe Licensee, thefollowingguidelines may be helpful:

Private Companies Generally a corporation, together with any other corporations under the same ownership and engaged in the same line of business, can be the Licensee. If the corporate group, however, has several distinct lines of business, each of which **may use** SPOT Data for different purposes, SPOT Image Corporation will treat each distinct business activity as a different Licensee.

Government Entities A government Licensee is a subdivision within a department or agency which has a specific mission for which SPOT Data will be used.

Joint Ventures A joint venture consists of two or more separate entities which have entered into a written agreement to work together on a specific project. The user license permits use by a joint venture to which the Licensee belongs. but under special conditions and guidelines. Consult the *Agreement on General Terms and Conditions* and the *License Request* form for details.

A joint venture **obviously** does not include an arrangement whose principal purpose istoobtain SPOT Data for several different users.

**Scope of License** A license granted by SPOT Image Corporation authorizes the Licensee to make very broad personal, or in the case of an organization internal, use of SPOT Data. No license governed by these terms and conditions will be an exclusive license.

A detailed explanation of the scope of a user **license and the rights of a licensee can be found in Section 3 of the** *Agreemenr on General Terms and Condirions.*

**Copies** Additional copies of CCTs and photographic items maybe obtained from SPOT image Corporation for a reduced fee. Licensee may also obtain the right to make copies of SPOT Data. Refer to the *Agreemenr on Genera/ Terms and Conditions* and the *License Requesr* form for specifics and applicable fees.

Delivery Licensed SPOT Data will be packaged, shipped and delivered to any destination in the United States free of charge.

**Catalog Inquiry** Acquired SPOT scenes are assigned a unique identification number and are listed in the **SPOT** *Catalog*. A request for data of a particular area is fulfilled either by searching the *SPOT Catalog* and identifying existing and applicable scenes or by programming the satellite to acquire new imagery.

To search already available scenes. a *Catalog Inquiry* form is used. A desired geographical area must be identified either **by** SPOT grid reference (GRS) coordinatesorbylatitude and longitude. In addition, such characteristics as spectral mode. viewing angle, and acquisition window must be specified. SPOT Image Corporation's Customer Services Representatives are available to assist you with catalog searches.

License **Requests** **A** license request must be accompanied by a signed copy of the *Agreemenr on Genera/ Terms and Conditions* unless an Agreement is already on file with SPOT Image Corporation. The license request:

- Names the Licensee;
- Describes the location of the SPOT Data to be licensed by **indicating** the SPOT Data Catalog scene identification number:
- Identifies the media in which the Licensee wants to obtain the SPOT Data: computer compatible tapes (CCTs). photographic film or prints.

The simplest way to submit a license request is to fill out a *License Requesr form* and deliver the completed form to SPOT Image Corporation. License requests may also be submitted by telephone. telex, facsimile. or any electronic communication which contains all the pertinent information.

A single license request can cover more than one scene and multimedia requests for the same scene. It also provides contact person, shipping. delivery and fee information.

Acquisition **Requests** **If** the desired SPOT Data are not already available from the SPOT archive, a request can be placed for programming **the** SPOT satellite to acquire the desired scenes. This procedure is initiated by submitting **an** *Acquisition Requesr* form which describes the scene location and acquisition parameters. such as cloud cover, acceptable time windows and viewing angles for the acquisition.

**In 1986 there will be no fee for requesting the acquisition of specific** SPOT scenes.

Fee Schedule The applicable fee for a particular license is determined by consulting the *SPOT Data Fee Schedule.* Standard fees are provided for both photographic and digital media.

SPOT Image Corporation offers special discounts for requesting duplicate and multimedia items for the same scene and level. Duplicate CCTs can be provided by SPOT Image Corporation or produced by the Licensee.

Generally, the license fee must be submitted at the time of the license request. Credit arrangements may be established. however, for qualified Licensees.

**Further Information** **Forfurtherinformationabout how to obtain SPOT Data user licenses, andforcopiesofthe** *Agreemenr on General Terms and Conditions, License Requesr* form, *Acquisition Requesr* form, *Fee Schedule.* and related material, please contact SPOT Image Corporation.

# SPOT Data Fee Schedule

## 1. Diqital Items (See back for details)

| Computer Compatible Tapes | | Formats Available | |
|---|---|---|---|
| | | 6250 bpi | 1600 bpi |
| Level 1A or 1B | All levels either Panchromatic or Multispectral | $1475 | $1600 |
| Level 2 or S | | 2425 | 2550 |

## II. Photographic I terns (See back for details)

| Black & White Transparencies | Scales Available | | |
|---|---|---|---|
| | 1:400,000 | 1:250,000 | |
| Level 1B | | | |
| Panchromatic (10m) | $ 765 | $850 | |
| Multispectral (20m - 3 bands) | 705 | 795 | |
| Multispectral (Per Band) | 280 | 310 | |
| Level 2, S | | | |
| Panchromatic (10m) | 1575 | 1720 | |
| Multispectral (20m - 3 bands) | 1570 | 1715 | |
| Multispectral (Per Band) | 590 | 640 | |
| **Black & White Prints** | | **1:250,000** | **1:100,000** |
| Level 1B | | | |
| Panchromatic (10m) | | $400 | $470 |
| Multispectral (20m - 3 bands) | | 370 | 440 |
| Multispectral (Per Band) | | 155 | 190 |
| Level 2, S | | | |
| Panchromatic (10m) | | 650 | 740 |
| Multispectral (20m - 3 bands) | | 645 | 735 |
| Multispectral (Per Band) | | 250 | 235 |
| **Color Transparencies** | **1:400,000** | **1:250,000** | |
| Level 1B | $770 | $ 910 | |
| Level 2, S | 1645 | 1790 | |
| **Color Prints** | | **1:250,000** | **1:100,000** |
| Level 1B | | $ 410 | $515 |
| Level 2, S | | 690 | 790 |

## III. Acquisition Fee (See back for details)

In 1986, no fee will be charged for satellite acquisition programming services

Effective February 1, 1986
Prices subject to change



SM 100 (2 1 86)

## General Information

**Terms and Conditions:** This Fee Schedule sets out the current fees for licenses to use SPOT Data All such licenses are provided under and subject to the terms of the *Agreement on General Terms and Conditions for SPOT Data User Licenses*. A signed Agreement must be on file with SPOT Image Corporation before you can obtain SPOT Data. If you have any questions please contact SPOT Image Corporation.

**SPOT Scene:** A SPOT scene covers an area of approximately 60x60 kilometers. All fees apply to a single SPOT scene Stereo coverage of a specific area requires two scenes. Information and specifications on all acquired and processed SPOT scenes are available from the SPOT Catalog.

Processing Levels:

Level 1 A- Equalization of detector responses. Relevant coefficients are provided for interband calibration and geometric correction.
Level 1 B-Same as Level 1 A. but resampled to correct for systematic geometric distortions.
Level 2 — Same as Level 1 B. but geometricallycorrectedtoa map projection utilizing ground control points (derived item).
Level S — Same as Level 2. but registered and resampled to a reference scene.

Acquisition Fee: In 1986. no fee will be charged for requesting SPOT Data which must be newly acquired by the SPOT satellite. To request such data complete an *Acquisition Request* form and return it to SPOT Image Corporation.

**SPOT Data Availability:** During 1986 *the SPOT archive for Level 2 items will be developed. This will be a phasing-in process* as an inventory of maps and ground control points is created and the production equipment and capability is brought on-line. Level 2 data will be available, but delivery times may be affected. Please consult with SPOT Image Corporation regarding the 1986 delivery schedule for Level 2 requests.

**Reference** Fee: When calculating the appropriate fee for requesting options, copies. and discounts, the term "reference fee" means the fee as listed in the current lee schedule for the specific *item to* which the option. copy, or discount will apply

*Options: SPOT Data Items and Options* defines the details and specifications of the standard items listed on the Fee Schedule. Nonstandard options to these standard specifications are also described. A surcharge of $100 is applied to the reference fee for an item when one or more nonstandard options are selected.

**Shipping and** Delivery: SPOT Image Corporation will, at its expanse, pack, ship, and deliver SPOT Data to destinations within the United States.

**Payment Terms:** Payment must be submitted with the license request. or in the case of electronic or telephone requests, within seven days. Payment can be by check or money order (please do not send cash]. Credit arrangements may be established for qualified licensees: please contact SPOT Image Corporation for details.

Taxes: Please add 4 % sales tax for *deliveries* in Virginia which are not subject to tax exemption.

## Digital Items

**Copies:** Additional copies of Digital Items may be obtained from SPOT Image Corporation or made by Licensee. Copies of CCTs produced by SPOT Image Corporation must be obtained at the time of the original license request. Up to 10 copies of a CCT may be obtained from SPOT image Corporation for a fee per copy equal to 20% of the reference fee. The fee for Licensee to make up to fifteen digital copies of a CCT is equal to the reference fee. "Digital copies" includes any digital media (hard, optical or floppy disk, CCT, etc.). If Licensee's request for making copies is not made as part of the original license request, an additional transaction fee of $100 will be applied.

Backup Copy: Licensee is authoriied to make one (digital medium) Backup Copy of licensed data provided in digital form.

## Photographic Items

**Copies:** Additional copies of Photographic Items can be obtained at a discount from SPOT Image Corporation when requested on the original license request. The lee for copies of Level 1 or 2 prints or transparencies is 50% of the Level 1 reference fee for the requested item. Copies are not subject to option surcharges or additional discounts.

Discounts: When Photographic and Digital Items of the same scene are requested together. a discount of 30% off the total fee for the Photographic Items will be applied.

Processing Availability: If the SPOT Catalog shows that an acquired scene has not been processed to the desired level, a license request for only photographic items of that scene may be rejected if the aggregate lee for the requested items is less than $700 for Level 1 and $15DO for Level 2.

**Projection** Scales: Photographic Items can be obtained at scales other than the standard scales shown on the Fee Schedule. This option is explained in *SPOT Data hems and Options.* The fee for nonstandard scales is equal to the fee for the next larger standard scale to the requested scale plus the option surcharge.

Print and Transparency Sizes: Size of prints may vary depending on media processing level and production facility The following table provides approximate dimensions for Level 1 frames.

| Scale | Dimensions |
|---|---|
| 1:400,000 | 24x24cm — 9.5x9.5 in |
| 1:250,000 | 48x48cm — 19x19 in |
| 1:100,000 | 96x96cm — 38x38 in |

# Agreement on General Terms and Conditions for SPOT Data User Licenses

SPOT Image Corporation has the exclusive right to license in the United States remotely sensed SPOT Data of the earth's surface acquired by SPOT satellites. The SPOT satellites are operated by the Centre National d'Etudes Spatiales of

(Name)

("Licensee"). Licensee may wish to obtain licenses from time to time to make limited use of specific SPOT Data. Each such license will require a license request from Licensee which, if accepted by SPOT Image Corporation, will give rise to a License Agreement. The purpose of the present Agreement is to establish general terms and conditions which will be part of each specific License Agreement into which the parties may enter in the future.

B. The License Agreement for any requested SPOT Data will consist of the license request, as accepted by SPOT Image Corporation, together with the terms and conditions contained in this Agreement.

C. In the case of a license request made by telephone, a written confirmation by SPOT Image Corporation will be deemed a correct statement of the license request unless a written correction to the confirmation is received by SPOT Image Corporation within three business days after the date of Licensee's receipt of such confirmation. In such event, Licensee's corrected request will be treated as a new license request.

2. ***License Fees***

The fee for any license granted in accordance with this Agreement will be determined on the basis of the applicable SPOT Image Corporation Fee Schedule, and, unless the parties agree specifically on credit terms, payment terms will also be in accordance with such Fee Schedule.

3. ***Scope of License***

A. The license granted by SPOT Image Corporation under the copyright and its other rights in the requested SPOT Data authorizes the Licensee to make personal or, in the case of an organization, internal use of the licensed SPOT Data as follows:

1) Licensee may analyze, process, and display the licensed SPOT Data, and may make such SPOT Data and the results of such analysis or processing available to employees of Licensee. For these purposes, Licensee may make, for internal business uses only, an unlimited number of copies of the SPOT Data in any manner which does not involve digital reproduction of data provided in digital form, provided that all copies include the copyright notice affixed to the original SPOT Data.

2) If the licensed data are provided in digital form, Licensee may make one digital copy of the SPOT Data for use as a Backup Copy, provided, however, that the Backup Copy is only for protection purposes and Licensee agrees not to use or allow others to use the Backup Copy for any purpose other than to replace the original data set if it is lost or damaged. Licensee may make additional digital copies of the SPOT Data to the extent authorized by the License Agreement, provided that all copies include the copyright notice affixed to the original SPOT Data.

3) Licensee may make the licensed SPOT Data available to contractors, consultants, and joint venturers who are not employees of Licensee, but [redacted] the contracting, consulting, or joint venture agreement.

4) Licensee may prepare textual reports and other nonimage materials based upon the licensed SPOT Data and publish, sell or distribute such materials, but only if such material does not reproduce in any way the licensed SPOT Data, except in the form of incidental pictorial illustrations which bear the copyright notice affixed to the original SPOT Data.

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4. ***Delivery***

Licensed SPOT Data will be delivered free of charge to any destination within the United States. SPOT Image Corporation will choose the method of delivery and will use its best efforts to deliver licensed SPOT Data as rapidly as is possible.

5. ***Limited Warranty and Limitation of Liability***

A. SPOT Image Corporation will use its best efforts to ensure that any SPOT Data provided to Licensee conform to the License Agreement and that the medium in which the data are delivered is free of physical defect. If any data or media do not meet the foregoing standards, Licensee's sole and exclusive remedy will be to return such data or media to SPOT Image Corporation within sixty (60) days of Licensee's receipt thereof. If Licensee returns data or media within such period and if SPOT Image Corporation reasonably determines that such data or media, at the time they were delivered to Licensee, failed to meet such standards, SPOT Image Corporation will, at its discretion, either (i) retain the data or media and refund the applicable license fee paid with respect to them, or (ii) replace or repair them and return them to Licensee.

Licensee represents and warrants that it will not use any SPOT Data licensed pursuant to this Agreement in any way which is unlawful or in breach of the legal rights of any third party.

7. ***Nonexclusivity***

No license governed by these terms and conditions will be an exclusive license, and SPOT Image Corporation may grant to other licensees nonexclusive licenses for any or all of the SPOT Data licensed under this Agreement. SPOT Image Corporation may also grant to other licensees, with respect to any or all of the SPOT Data licensed pursuant hereto, exclusive or nonexclusive licenses for the commercial reproduction and distribution of such SPOT Data. No such exclusive license, however, will diminish the rights of Licensee under this Agreement.

8. ***General***

This Agreement supersedes all previous oral or written agreements or representations concerning the subject matter of this Agreement. This Agreement may not be changed, amended, or modified in any way except by a writing executed by both parties, provided, however, that either party may terminate this Agreement by written notice to the other party. Termination of this Agreement shall not terminate or affect any license in effect at the time of such termination granted in accordance with this Agreement. If any provision of this Agreement is held invalid, illegal, or unenforceable, the validity, legality and enforceability of the remaining provisions will not be in any way affected or impaired. This Agreement will be governed by the laws of Virginia, and the Licensee hereby submits to the jurisdiction of any competent state or federal court located in Virginia with respect to any dispute or claim relating to this Agreement.

For Licensee: Name & Title (Please type or print)

For SPOT Image Corporation: Name & Title

**Please fill in the requested information so we may open an account for you.**
**Please** PRINT IN ALL CAPS to **avoid any errors**

Type of Business (Check One):

- ☐ Corporation
- ☐ Non-Profit Organization
- ☐ Government Entity
- ☐ Individual
- ☐ Partnership

Are you a U.S. corporation or resident? ☐ Yes ☐ No

**Licensee** Name (If "Individual" checked above. enter individual's name; otherwise enter organization name)

Contact Name (Name of Person responsible for this account)

Corporate **Address**

| **Number** | Street | **Suite** |
|---|---|---|
| City | state | ZIP Code |

**Billing** Address

| Number | Street | Suite |
|---|---|---|
| City | State | ZIP Code |

Shipping Address

| Number | Street | Suite |
|---|---|---|
| City | State | ZIP Code |

| Telephone ( ) | Telex |
|---|---|

**For SPOT Image Corp. Use Only - DO NOT FILL IN**

Licensee Name

Licensee ID Number

Account Start Date

**Authorization Number**

BARRINGER GEOSERVICES
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687 FAX NO. (303) 277-1689

Hay 31, 1988

R. H. Griffin
Soil Conservation Service
P.O. Box 6567
Fort Worth, Texas 76116

RE: Barringer Orthoimage

Dear Mr. Griffin,

Below I have listed updated costs for generation of one 7.6 minute U.S.G.S. Orthoimage map using only SPOT Panchromatic 10 meter imagery. I regret giving you inaccurate information regarding costs in our last telephone conversation.

COST FOR FIRST ORTHOIMAGE WHOLLY INCLUDED IN ONE SPOT SCBNB:

| | | |
|---|---|---|
| Data acquisition | | $ 1,900.00 |
| Rectification and processing cost | | $ 2.130.00 |
| Hard copy fees | | $ 400.00 |
| | TOTAL | $ 4.430.00 |

DELIVERABLES:

All original SPOT digital data (digital processed imagery available upon request).

One 10"X10" black and white film negative of Orthoimage (fully annotated).

One 20"X30" black and white Kodak photographic enlargement at 1:24,000 scale of Orthoimage.

Stanley Perry

Report of the Southern Regional Soil Taxonomy Committee, 1988

Part 1 - Disposition of unfinished items from June 1, 1986 report

May 15, 1986 - The change is in SMSS Technical Mon. Number 6. Changed by N.S.H., Issue Number 10, May 29, 19137

March 12, 1986 - Sent in October 27, 1986. Approved November 16. 1987, in N.S.H., Issue Number 11.

November 18, 1985 - The changes are in SMSS Technical Mon. Number 6. Changed in N.S.H., Issue Number 9, October 10, 1986.

November 19, 1985 - Taken care of in SMSS Technical Mon. Number 6.

Report of the Southern Regional Soil Taxonomy Committee, 1988

Part 2 - Items proposed since the last SRTWPC

Adding Arenic and Grossarenic Umbraqualfs. Approved by the SRTWPC Committee and sent to John Witty, November 10, 1987.

Adding Alfic and Ustalfic subgroups to Quartzipsamments. Delete the Ultic subgroup of Udipsamments. The SRTWPC Committee approved by a majority but not unanimously. Richard Mayhugh sent the recommendation to Rodney Harner, March 14, 1988.

Adding the Grossarenic Ultic subgroup to Haplohumods. Approved by the SRTWPC Committee by a 2 to 1 vote and sent to John Witty, March 17, 1988.

Add the definition to Fraglossudalfs, the distinction between Typic Fraglossudalfs and other subgroups, and the description of the typic subgroups. Sent to John Witty, October 27, 1986. Approved in N.S.H.. Issue Number 11. November 16, 1987, page 615-160, items 615.47.

Taxonomy Commitee Members

Elected at the 1986 Southern Regional Technical Work Planning Conference

| Term Expires at the Work Planning Conf. or in June of Alternate Years | State Representatives | Federal Representatives |
|---|---|---|
| 1989 | Dr. A.D. Karathanasis | John Robbins |
| 1990 (Term began in 1987) | Dr. Mary E. Collins | B. Arville Touchet |

Elected at the 1988 Southern Regional Technical Work Planning Conference

| Term Expires at the Work Planning Conf. or in June of Alternate Years | State Representatives | Federal Representatives |
|---|---|---|
| 1991 | Dr. Brian Carter | C. L. Girdner |
| 1992 (Term begin in 1989) | Dr. Randy Brown | Adam Hyde |

Agency - SCS - Meeting - George Martin Presiding

1. Members of the Southern Regional Taxonomy Committee elected for the term to begin in 1989 were: C. L. Girdner and Adam Hyde

2. Bill Roth - National Headquarters

   The FY-89 budget for soils looks to be at about the same level as FY-88.

   Five million dollars has been requested as an appropriation for GIS and Digitizing activities in 1990.

3. General Discussion

   Considerable discussion related to editing manuscripts, desk top publishing and staffing.

1988 SOUTHERN REGIONAL WORK PLANNING CONFERENCE
June 13-17, 1988
Knoxville, Tennessee

Committees

I. Soils Laboratory Data Bases

Chairman: Carter Steers

Charges: 1. Develop a plan for reforming and combining the State Soil Survey Laboratory data files and the National Soil Survey Laboratory data files for a central user access system.

2. Make recommendations for a schedule of cooperative listing and evaluation of an automated laboratory data base system.

II. Soil Interpretations

Chairman: DeWayne Williams

Charge: 1. Identify and characterize soil characteristics that affect soil interpretations.

III. Laboratory Methods and Analysis

Chairman: B. R. Smith

Charge: 1. The exchange of selected soil samples among laboratories in the South Region and the National Soil Survey Laboratory with the objective of determining varability within and between the participating laboratories for common characterization analysis and procedures.

IV. Soil water

Chairman: E. Moye Rutledge

Charges: 1. Keep the Southern Regional Soil Survey Work Croup informed on proposals of the International Committee (ICOMAQ) and any related activities within our region.

2. Develop guides for collecting a soil water data base.

V. Soil Survey and Management of Forest Lands

Chairman: Jim Keys

Charge: 1. To address the development of specific interpretations needed for soil surveys where the major land use is forestry.

2. To determine suitable ways to present forestry interpretations in soil survey reports.

VI. Mine spoil - Classification and Interpretation

Chairman: John T. Ammons

Charge: 1. Establish criteria to inventory mine lands.

COMMITTEE I: SOILS LABORATORY DATA BASES

Committee Membership:

Carter Steers, Chairman
John Meetze
Bill Craddock
Victor Carlisle
Ellis Benham - Vice Chairman
B. L. Allen
C. R. Berdanier
Terry Cook
C. L. Girdner, Jr.
H. J. Kleiss
W. I. Smith
Ellis Knox

Earl Blakley
Everett Cole
Craig Ditzler
Benny Brasher
Frederick Beinroth
Mary F. Collins
R. T. Fielder
R. H. Griffin
Gregg w. Schellentrager
Gilberto Acevedo

Charges:

1. Develop a plan for reforming and combining the State Soil Survey Laboratory data files and the National Soil Survey Laboratory data files for a central user access system.

2. Make recommendations for a schedule of cooperative listing and evaluation of an automated laboratory data base system.

Response to charges: There is a great need for an integrated NCSS laboratory data base for physical, chemical, and pedon descriptive information as indicated by 100 percent of respondence to questionnaire. This questionnaire, which was sent to all State Soil Scientists and to the southern states experiment station representatives, also indicated the following desires: assistance would be provided by state soil staffs and by experiment station personnel, mainly in review consultation and user testing of data bases; 96 percent indicated such assistance available; 11 percent indicated they could also provide some software development assistance. The questionnaire shows 95 percent of the respondents think this data base is fast becoming a requirement for NCSS and 53 percent of the respondents rate this data base development as high priority and most place Food Security Act, field mapping, and STATSGO as higher priorities.

Considerable interest was shown in this committee's responsibilities during discussion group. Discussion included the following topic: data formats and scheme, location of central data base, responsibilities for data maintenance, distribution procedures to state systems. update and access procedures, policy and criteria for data entry, system software and hardware for retrieval, quality control, review and culling of data files, prototypes systems and testing, site specifics for data entry, analysis and query, data base design for pedon description and charaoteristization analysis, and considerable talk centered around the National Soil Characterization Data Base Development Committee.

Recommendation of committee (charge 1):
A central data base be consolidated at Lincoln, Nebraska, which will include NSSL and state soil survey laboratory data with the responsibility for funding, personnel, and maintenance provided by SCS. In addition, we highly suggest the following guidelines be used:

A. Central system will interface with state system and will be designed and formatted in such a manner as to accommodate state data needs and file code where possible.

B. State have option as to where repository for state data base is located and not bound by UNIX operating system.

C. NSSL will be given a high priority for data base design and states interface for this system.

D. The university and state experiment station representatives will provide guidance and assistance in pilot testing of systems.

Recommendation no. 2 (charge 1):

The State Soil Scientist and Agriculture Experiment Station Representative will cull their data and arrange for sample entry into central data base. All data entry samples will be accompanied by a completed Soils-g form. Use of taxajunct is recommended. This committee would also request that an inventory be conducted and report prepared for states, file format, and hardware used by state systems.

Recommendation no. 3 (charge 1):

Policy will be developed to require UTM coordinates for location of all laboratory samples and pedon descriptions.

Recommendation no. 4 (charge 1):

The SCS investigate the use of cooperative agreement with state universities or state experiment stations to provide system analysis and software development expertise in the design and testing of this central data base.

Recommendation no. 1 (charge 2):

The responsibility of this committee be transferred to the National Committee for Soil Characterization Data Base Development (NSCDB) and that at least two members from the South Regional Work Planning Conference be selected for this committee and one member each from Agricultural Experimentation Stations and SCS.

Recommendation no. 2 (charge 2):

Although no schedule is recommended for the development of this central data base, we suggest the NSCDB committee develop a schedule that **would have a test system within the next two years.**

Recommendation no. 3 (charge 2):

That this committee be discontinued.

Recommendation no. 4 (charge 2):

That this committee report be accepted by the South Regional Work Planning Conference body.

COMMITTEE II: Soil Interpretations, Southern Regional Soil Survey Work-Planning Conference of The National Cooperative Soil Survey.

**Charge:** identify and characterize soil characteristics that affect soil interpretations.

This committee reviewed the current rating guide in the National Soil Handbook and considered other interpretations that need attention. The following is a list of suggestions and recommendations:

1. Recommend changes in the current rating guides.

   a. Bulk density as related to rooting depth - use family texture criteria in National Soil Handbook rather than 1.7.

   b. Computerize footnotes.

   c. Remove slope criteria from pond resorvior area guide.

   d. Rate the taxonomic concept rather than the typical pedon for arenic, grossarenic, and soils less than 40 inches to bedrock, petrocalcic, petrogypsic, fragipans, or contracting textures. Other taxonomic concepts may need to be identified and included.

      This is desirable because of such things as available water. A soil typified near the upper limit would give a different profile AWC than one typified near the lower limit.

   e. The soil reaction in the rating guide for Top Soil of "less than 3.6" is too low. A reaction of "less than 5.0" is recoannended.

2. Gather data on slope length, shape and position.

   a. Encourage the use of new 232 pedon description form.

   b. Encourage states to require field parties to collect this data on a routine basis.

3. Recommend that each state set up a site or sites to record soil temperature data at depths of 1 and 2 meters.

4. Recommend that states take initiative to gather tempera1 data on such as:

   a. nitrogen

   b. phosphorus

   c. water stable aggregation

   d. intake rates

   This data needs to be qualified as to land use; ie.. cultivated, pasture, range, forestry.

5. Recognized the need for developing.

   a. Adsorptive capacity for selected cations.

   b. adsorptive capacity for animal waste.

   c. adsorptive capacity for heavy metals.

   d. adsorptive capacity for pesticides.

   e. adsorptive capacity for herbicides.

6. Recognized the need to collect better data on the kind and nature of bedrock, ie., level bedded, tilted, degree of fractering.

7. Recognized the need to develop interpretations on "Use of Soil Material as Filter for Septic Systems.".

8. Recognized the need to define the term "Renewable" as related to "T" factor.

9. Recognized the need to develop guide to rate soils for potential or susceptibility to development of plow pans.

10. Recognized the need to develop layman explanations for "what is the basis for interpretations"?

Continuance of the Committee:

It is recommended that the committee or interpretations be continued to pursue items recognized by this committee and/or items that come to the forfront following this conference.

Committee Members:

| | |
|---|---|
| George Martin | Richard Rehner |
| Adam Hyde | Raymond Sims |
| R.B. Brown | Billy Wagner |
| William Smith | Orville Whitaker |
| Ben Stuckey | Jerry Ragus |
| Talbert Gerald | Arville Touchet |
| Tom Coleman | Warren Henderson |
| Wade Hurt | Andy Goodwin |
| Don Hallbick | S.J. Dunn |
| Robert Wilkes | DeWayne Williams, Chair |

## COMMITTEE III. LABORATORY METHODS AND ANALYSIS

| committee: | B.R. Smith, Chairman | Brian Carter |
|---|---|---|
| | Larry Ratliff | W.G. Harris |
| | Charles McElroy | E.N. Hayhurst |
| | Ben Hajek | Warren Henderson |
| | Tom Hallmark | W.A. Hill |
| | A.D. Karathanasis | J.H. Soileau |
| | Warren Lynn | L.B. Ward |
| | Tom Reinsch | Doug Wysocki |

Charge: The exchange of selected soil samples among laboratories in the South Region and the National Soil Survey Laboratory with the objective of determining variability within and between the participating laboratories for common characterization analysis and procedures.

A total of 6 samples were analyzed in triplicate by 12 soil characterization laboratories. The analyses and methods used are listed in Table 1, and are from Soil Survey Investigations Report No.1, 1972 revision. All labs did not perform every analysis, and so there are some blanks in the tables of the various properties.

Labs that participated are Auburn University, Clemson University, University of Florida, University of Georgia, University of Kentucky, Louisiana state, Mississippi state, National Soil Survey Lab-Lincoln, North Carolina State, University of Tennessee-Knoxville, and Texas A&M. The sample code and the classification of the soils are listed in Table 2.

Means of each property for each sample-lab combination were determined. Means, ranges, and standard error of mean (S.E.) of each sample for each property were then determined. All of these are reported in the tables of properties. Statistical analysis of clay mineralogy was not done.

Considerable variation exists for values reported for total sand, silt, and clay. Samples 1 and 6 had the greatest ranges for total silt and clay and highest S.E.'s. However, only one soil (6) would have been placed in the wrong textural family by just one lab (C). Two labs (C and H) reported noticeably higher sand contents for sample 6.

Sample 1 contains appreciable free $CaCO_3$ (-18%). Consequently, values reported for exchangeable Ca, CEC (sum of cations), CEC ($NH_4OAc$, pH 7.0). and ECEC vary considerably for this sample, since $NH_4OAc$, pH 7.0 used dissolved some of the carbonate. Extractable acidity and base saturation also vary for sample 1, but these measurements are rather meaningless for a soil that contains -18% free $CaCO_3$.

There is considerable variation in exchangeable Ca and Mg and extractable acidity for sample 3. As a result, CEC (sum of cations), ECEC. and base saturation vary quite a bit. However, the soil would not have been misclassified by any of the labs.

The value reported by lab F for sample 2 for CEC ($NH_4OAc$, pH 7.0) on a clay basis is 17.1 cmol $kg^{-1}$. This soil would have been misclassified by lab F because the presence of a kandic horizon would have been missed. All labs reported ECEC values of <12 cmol $kg^{-1}$ on a clay basis for sample 2.

All labs reported ECEC and CEC ($NH_4OAc$, pH 7.0) values on a clay basis of <12 and <16 cmol $kg^{-1}$, respectively, for sample 5. All labs would have noted the presence of a kandic horizon and classified the soil correctly.

Labs C, F, and L reported values for ECEC greater than 1.5 cmol $kg^{-1}$ clay for sample G. This soil would have been misclassified by these labs.

The 8 labs that determined clay mineralogy reported reasonably similar values for the samples. Soils 1 and 2 would have been placed in the correct mineralogical family by all labs. Based on these data, soil 3 should be classified as montmorillonitic, not illitic. If the sample is representative, it appears that this soil is presently misclassified. Although the Dothan (samples 4 and 5) belongs to a fine-loamy family, the labs reported similar clay mineralogy. Free iron oxides were not determined, so the oxidic mineralogy of soil 6 cannot be verified, but clay mineralogy values reported are similar.

Some variation exists among the labs for the various properties determined. However, there is fairly good agreement for many of the properties determined. One lab would have misclassified soil 2 and 3 labs would have misclassified soil 6. Each lab should study the data and see if the values it reported are in agreement or out-of-line with those reported by the other labs. If certain values appear to be particularly at variance for some properties, then en examination of those methods and procedures by that lab would seem in order.

In summary, the labs should be encouraged to learn that the soil characterization data they are providing is reasonably precise, accurate, reliable, and nearly always results in the proper classification of the soils analyzed.

Recommendations:

1. It is recommended that this committee not be continued.
2. It is recommended that a new committee be formed for the distribution of a few selected reference samples to various state highway departments that wish to participate and the Soil Mechanics Lab in Ft. Worth. The committee would decide what engineering properties would be determined. This would allow en evaluation of variation of engineering test data. It is recommended that Charlie McElroy serve es chairman of this new committee.

Table 1. Analyses and Methods

| Analyses | Methods * |
| --- | --- |
| Particle size distribution | 3A1 (pipette) |
| Cation exchange capacity | 5A1 ($NH_4OAc$, pH 7.0) |
| CEC, sum of bases | 5A3a (acidity + bases) |
| ECEC | 5A3b (Al + bases) |
| Exchangeable bases | 5A1 ($NH_4OAc$, pH 7.0) |
| Ca | 6N2e (AA) |
| Mg | 602d (AA) |
| Na | 6P2b (AA) |
| K | 6Q2b (AA) |
| Extractable acidity | 6H1 ($BaCl_2$-TEA, pH 8.2) |
| Exchangeable Al | 6Gle (KCl, AA) |
| Base saturation | 5C3 (sum of cations) |
| pH | 8Cla, 8Clc, 8Cle |
| Organic carbon | 6Ala or 6A2 (acid dichromate digestion or dry combustion) |
| $CaCO_3$ equivalent (on samples where appropriate) | 6Ele |
| Clay mineralogy | Methods currently used by each laboratory |

* SSIR 1, 1972 Revision unless otherwise stated

Table 2. Soil Samples Used

| Sample | Horizon | Series | Classification |
|---|---|---|---|
| 1 | A | Houston Black | fine, montmorillonitic, thermic Udic Pellusterts |
| 2 | Btl | Pacolet | clayey, kaolinitic, thermic Typic Kanhapludults |
| 3 | Bt | Clarence | fine, illitic, mesic Aquic Arguidolls |
| 4 | Ap | Dothan | fine-loamy, siliceous, thermic Plinthic Kandiudults |
| 5 | Btv2 | Dothan | fine-loamy, siliceous, thermic Plinthic Kandiudults |
|  | B4 | Nipe | clayey, oxidic, isohyperthermic Typic Acrudox |

Table 3. Very Coarse Sand, %

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | .O | 6.1 | .2 | 3.5 | 2.4 | 1.1 |
| B | .1 | 5.9 | .2 | 3.1 | 2.3 | .8 |
| C | .3 | 4.4 | .2 | 2.8 | 1.8 | .6 |
| D | .6 | 4.2 | .4 | 3.0 | 1.9 | .7 |
| E | .4 | a.3 | .1 | 4.4 | 5.3 | 1.9 |
| F | .1 | 5.3 | .1 | 3.3 | 2.4 | .7 |
| G | - | 5.1 | .2 | 3.0 | 1.9 | .8 |
| H | .3 | 5.3 | .1 | 3.0 | 2.1 | 1.1 |
| I | .3 | 5.8 | .4 | 2.7 | 2.0 | 1.1 |
| J | .6 | 8.6 | .2 | 5.0 | 3.1 | 1.0 |
| K | .2 | 4.2 | .2 | 2.6 | 2.3 | .5 |
| L | .2 | 4.8 | .2 | 2.4 | 2.4 | 1.1 |
| Mean | .3 | 5.1 | .2 | 3.3 | 2.5 | 1.0 |
| Range | .0-.6 | 4.2-8.6 | .1-.4 | 2.4-5.0 | 1.8-5.3 | .5-1.9 |
| S.E. | 0.04 | 0.26 | 0.02 | 0.14 | 0.18 | 0.07 |

Table 4. Coarse Sand, %

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | .0 | 9.7 | .4 | 12.2 | 8.3 | 1.2 |
| B | .5 | 10.1 | .7 | 13.5 | 7.9 | .9 |
| C | .3 | 9.8 | .4 | 12.4 | 7.8 | 1.4 |
| D | .7 | 10.8 | .6 | 11.9 | 8.6 | 1.4 |
| E | .6 | 11.0 | .5 | 11.6 | 11.9 | 1.7 |
| F | .3 | 9.5 | .4 | 10.5 | 7.5 | 1.2 |
| G | | 10.8 | .4 | 12.9 | 8.7 | 1.2 |
| H | .5 | 8.8 | .3 | 12.4 | 7.5 | 1.3 |
| I | .4 | 9.6 | .5 | 11.1 | 8.4 | 1.2 |
| J | .7 | 10.1 | .6 | 15.6 | 11.1 | 1.4 |
| K | .4 | 9.7 | .4 | 9.8 | 7.9 | 1.0 |
| L | .4 | 9.6 | .2 | 10.2 | 8.7 | 1.2 |
| Mean | .5 | 10.0 | .4 | 11.9 | 8.7 | 1.2 |
| Range | .0-.7 | 8.8-11.0 | .2-.7 | 9.8-15.6 | 7.5-11.9 | .9-1.7 |
| S.E. | 0.04 | 0.13 | 0.03 | 0.38 | 0.25 | 0.04 |

Table 5. Medium Sand, %

| lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | .2 | 12.1 | .5 | 23.6 | 17.3 | 1.2 |
| B | .8 | 12.1 | .7 | 23.6 | 17.2 | 1.1 |
| C | .5 | 12.4 | .6 | 23.2 | 17.2 | 2.0 |
| D | .5 | 12.0 | .6 | 23.6 | 16.8 | 1.3 |
| E | .4 | 8.3 | .5 | 17.9 | 13.1 | .a |
| F | .6 | 12.3 | .5 | 22.0 | 17.1 | 1.0 |
| G | | 11.3 | .6 | 22.9 | 16.3 | 1.3 |
| H | .6 | 12.0 | .6 | 24.8 | 17.4 | 1.8 |
| I | .6 | 11.3 | .5 | 21.0 | 15.8 | 1.3 |
| J | .4 | 7.8 | .4 | 16.6 | 12.0 | .8 |
| K | .5 | 11.7 | .5 | 21.3 | 16.0 | 1.1 |
| L | .5 | 12.5 | .5 | 23.1 | 18.4 | 1.2 |
| Mean | .5 | 11.2 | .5 | 21.9 | 16.2 | 1.2 |
| Range | .2-.8 | 7.8-12.5 | .4-.7 | 16.6-24.8 | 12.0-18.4 | .8-2.0 |
| S.E. | 0.03 | 0.27 | 0.02 | 0.43 | 0.32 | 0.05 |

Table 6. Fine Sand, %

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | .6 | 11.0 | .6 | 30.6 | 24.7 | 2.3 |
| B | 1.2 | 11.5 | .6 | 32.1 | 26.2 | 1.9 |
| C | 1.3 | 11.8 | .8 | 31.0 | 25.0 | 6.0 |
| D | 1.0 | 12.0 | .6 | 33.9 | 26.3 | 2.4 |
| E | 1.1 | 11.2 | .9 | 34.1 | 24.0 | 1.9 |
| F | 1.2 | 11.3 | .6 | 32.8 | 24.8 | 1.6 |
| G | | 11.8 | .8 | 32.5 | 25.7 | 2.3 |
| H | 1.0 | 11.8 | .7 | 32.8 | 25.1 | 5.5 |
| I | 1.1 | 11.9 | .6 | 32.2 | 25.0 | 2.5 |
| J | 1.0 | 12.1 | .9 | 34.0 | 27.1 | 2.0 |
| K | 1.2 | 12.9 | .7 | 34.2 | 26.6 | 2.0 |
| L | 1.1 | 11.4 | .6 | 34.0 | 24.4 | 2.4 |
| Mean | 1.1 | 11.7 | .7 | 33.0 | 25.5 | 2.5 |
| Range | .6-1.3 | 11.0-12.9 | .6-.9 | 30.6-34.8 | 24.4-27.1 | 1.6-6.0 |
| S.E. | 0.03 | 0.09 | 0.02 | 0.24 | 0.18 | 0.21 |

Table 7. Very Fine Sand, %

| lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | .8 | 4.3 | .8 | 13.5 | 13.4 | 3.2 |
| B | 2.0 | 5.2 | 2.6 | 14.5 | 14.0 | 2.7 |
| C | 1.8 | 5.2 | 1.2 | 15.4 | 15.0 | 7.2 |
| D | 1.7 | 5.0 | .9 | 16.4 | 15.1 | 3.6 |
| E | 2.0 | 4.5 | 1.1 | 13.2 | 12.4 | 2.5 |
| F | 2.0 | 4.8 | 1.6 | 13.5 | 13.6 | 2.4 |
| G | | 4.9 | .8 | 13.7 | 14.2 | 2.5 |
| H | 1.6 | 4.8 | .9 | 14.2 | 14.8 | 6.1 |
| I | 1.3 | 4.5 | .4 | 15.2 | 14.0 | 2.6 |
| J | 1.9 | 4.8 | 1.2 | 15.3 | 14.3 | 3.1 |
| K | 1.5 | 4.8 | .8 | 15.5 | 13.8 | 2.6 |
| L | 1.1 | 3.8 | .6 | 13.3 | 11.3 | 2.6 |
| Mean | 1.6 | 4.7 | 1.0 | 14.4 | 13.8 | 3.4 |
| Range | .8-2.0 | 3.8-5.2 | .4-2.6 | 13.2-16.4 | 11.3-15.1 | 2.4-8.1 |
| S.E. | 0.07 | 0.07 | 0.10 | 0.25 | 0.21 | 0.31 |

Table 8. Total Sand, %

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | 1.6 | 43.3 | 2.5 | 83.5 | 66.1 | 9.0 |
| B | 4.8 | 45.1 | 5.0 | 67.1 | 47.9 | 7.6 |
| C | 4.2 | 43.6 | 3.2 | 84.6 | 66.8 | 17.2 |
| D | 4.6 | 44.0 | 3.2 | 88.8 | 69.2 | 9.4 |
| E | 4.4 | 43.3 | 3.0 | 84.6 | 67.5 | 8.9 |
| F | 4.2 | 43.3 | 3.2 | 82.4 | 65.3 | 6.9 |
| G | | 43.9 | 2.6 | 85.3 | 66.9 | 8.1 |
| H | 4.0 | 42.7 | 2.5 | 86.1 | 66.8 | 17.8 |
| I | 3.6 | 43.1 | 2.5 | 82.2 | 65.2 | 8.7 |
| J | 4.6 | 44.2 | 3.1 | 87.3 | 67.6 | 8.1 |
| K | 3.8 | 43.3 | 2.7 | 83.4 | 66.4 | 7.1 |
| L | 3.0 | 42.1 | 2.1 | 82.9 | 65.2 | 8.6 |
| Mean | 4.0 | 43.5 | 3.0 | 84.9 | 66.7 | 9.3 |
| Range | 1.6-4.8 | 42.1-45.1 | 2.1-5.0 | 82.2-88.8 | 65.2-69.2 | 6.9-17.8 |
| S.E. | 0.15 | 0.17 | 0.55 | 0.38 | 0.21 | 0.57 |

Table 11. pH, Water

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | 7.7 | 5.4 | 5.9 | 5.4 | 5.4 | 6.1 |
| B | 7.5 | 5.6 | 6.3 | 5.5 | 5.1 | 5.3 |
| C | 7.4 | 4.5 | 5.6 | 4.7 | 4.6 | 4.7 |
| D | 7.6 | 5.2 | 6.1 | 5.3 | 5.3 | 5.8 |
| E | 7.6 | 6.0 | 6.0 | 5.6 | 5.3 | 6.1 |
| F | 7.5 | 5.8 | 5.8 | 5.8 | 5.7 | 6.7 |
| G | | 5.0 | 5.9 | 5.2 | 4.9 | 5.8 |
| H | 7.6 | 5.0 | 6.0 | 5.3 | 4.9 | 5.6 |
| I | 7.4 | 4.3 | 5.5 | 4.8 | 4.2 | 4.6 |
| J | 7.6 | 4.8 | 5.9 | 4.9 | 4.7 | 5.2 |
| K | 7.2 | 5.2 | 5.9 | 5.2 | 5.1 | 5.6 |
| L | 7.7 | 5.4 | 6.4 | 5.6 | 5.3 | 6.0 |
| Mean | 7.5 | 5.1 | 5.9 | 5.3 | 5.0 | 5.6 |
| Range | 7.2-7.7 | 4.3-6.0 | 5.6-6.4 | 4.7-5.8 | 4.2-5.7 | 4.6-6.7 |
| S.E. | 0.03 | 0.09 | 0.05 | 0.06 | 0.07 | 0.11 |

Table 12. pH, $CaCl_2$

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | 6.6 | 4.0 | 4.7 | 4.2 | 4.0 | 6.1 |
| B | 7.4 | 4.4 | 5.3 | 4.5 | 4.0 | 5.1 |
| C | 6.6 | 5.2 | 5.3 | 4.5 | 4.0 | 5.0 |
| D | | | - | | | |
| E | | | | | | |
| F | 7.2 | 5.5 | 5.8 | 5.5 | 4.5 | 5.5 |
| G | | | | | | |
| H | 7.3 | 4.5 | 5.6 | 4.7 | 4.3 | 5.8 |
| I | 7.2 | 4.0 | 5.3 | 4.4 | 3.8 | 5.4 |
| J | 7.3 | 4.2 | 5.4 | 4.4 | 4.0 | 5.6 |
| K | | | | | | |
| L | 7.0 | 4.4 | 5.5 | 4.7 | 4.1 | 5.5 |
| Mean | 7.2 | 4.5 | 5.4 | 4.6 | 4.1 | 5.5 |
| Range | 6.6-7.4 | 4.0-5.5 | 4.7-5.8 | 4.2-5.5 | 3.8-4.5 | 5.0-6.1 |
| S.E. | 0.06 | 0.11 | 0.06 | 0.08 | 0.05 | 0.06 |

Table 13. pH, KCl

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | | 2 | 3 | 4 | 5 | 6 |
| A | 7.4 | 4.6 | 5.6 | 4.7 | 4.3 | 5.7 |
| B | - | | | | | - |
| C | 6.7 | 4.4 | 5.0 | 4.3 | 4.3 | 6.1 |
| D | | | | | | |
| E | - | | | | | |
| F | 6.4 | 4.4 | 4.7 | 4.6 | 4.2 | 5.7 |
| G | | 4.1 | 4.9 | 4.4 | 4.2 | 6.1 |
| H | | 3.9 | 4.6 | 4.3 | 4.0 | 6.1 |
| I | 6.5 | 3.8 | 4.4 | 4.0 | 3.8 | 6.0 |
| J | 6.6 | 3.9 | 4.6 | 4.2 | 4.1 | 6.2 |
| K | | | | | | |
| L | 6.6 | 4.1 | 4.7 | 4.2 | 4.0 | 6.1 |
| Mean | 6.6 | 4.1 | 4.7 | 4.3 | 4.1 | 6.0 |
| Range | 6.4-7.4 | 3.8-4.6 | 4.4-5.6 | 4.0-4.7 | 3.8-4.3 | 5.7-6.2 |
| S.E. | 0.07 | 0.05 | 0.06 | 0.05 | 0.03 | 0.04 |

Table 14. Exchangeable Ca, cmol $kg^{-1}$

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | 47.55 | .99 | 9.11 | .73 | .07 | .04 |
| B | 53.17 | 1.27 | 12.17 | .85 | .10 | .10 |
| C | 91.75 | 1.78 | 17.75 | .94 | .18 | .14 |
| D | 84.53 | 1.13 | 11.77 | .90 | .10 | .10 |
| E | 42.73 | .84 | 7.68 | .58 | .09 | .16 |
| F | 71.50 | 3.10 | 16.10 | 1.40 | .17 | .10 |
| G | - | 1.30 | 12.76 | .86 | .13 | .14 |
| H | 91.90 | 1.47 | 12.70 | 1.10 | .17 | .23 |
| I | 75.93 | 1.40 | 10.70 | .87 | .10 | .00 |
| J | 95.93 | 1.25 | 9.26 | .91 | .13 | .11 |
| K | 79.60 | 1.33 | 10.93 | .90 | .23 | .17 |
| L | 62.33 | 1.67 | 12.07 | 1.17 | .47 | .37 |
| Mean | 72.59 | 1.45 | 11.75 | .93 | .16 | .14 |
| Range | 42.73-95.93 | .84-3.10 | 7.68-17.75 | .73-1.40 | .07-.47 | .00-.37 |
| S.E. | 3.19 | 0.10 | 0.44 | 0.04 | 0.02 | 0.02 |

Table 15. Exchangeable Mg, cmol $kg^{-1}$

| Lab | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|---|---|---|---|---|
| A | .50 | .16 | 5.89 | .10 |
| B | 1.57 | .41 | 20.89 | .30 |
| C | 1.52 | .25 | 19.75 | .29 |
| D | 1.63 | .50 | 19.43 | .33 |
| E | .50 | .40 | 7.71 | .22 |
| F | 1.77 | .83 | 22.30 | |
| G | | .48 | 18.69 | |
| H | 1.70 | .53 | 17.63 | |
| I | 1.47 | .50 | 15.20 | |
| J | .92 | .26 | 10.93 | |
| K | 1.43 | .37 | 15.00 | |
| L | 1.57 | .53 | 18.53 | |
| Mean | 1.35 | .44 | 15.89 | |
| Range | .50-1.77 | .16-83 | 5.89-22.30 | |
| S.E. | 0.08 | 0.03 | 0.87 | |

| Lab | |
|---|---|
| A | |
| B | |
| C | |
| D | |
| E | |
| F | |
| G | |
| H | |
| I | |
| J | |
| K | |
| L | |
| Mean | |
| Range | |
| S.E. | |

## Table 17. Exchangeable Na, cmol $kg^{-1}$

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | | 2 | 3 | 4 | 5 | 6 |
| A | .16 | .03 | .09 | .03 | .02 | .03 |
| B | .91 | .15 | .80 | .17 | .15 | .15 |
| C | .50 | .03 | .33 | .02 | .01 | .02 |
| D | .57 | .10 | .43 | .10 | .10 | .10 |
| E | .57 | .08 | .40 | .13 | .09 | .06 |
| F | .77 | .10 | .10 | .27 | .00 | .30 |
| G | | .03 | .37 | .02 | .01 | .02 |
| H | .53 | .07 | .40 | .07 | .03 | .07 |
| I | 2.77 | .10 | 1.73 | .00 | .00 | .00 |
| J | .45 | .03 | .35 | .02 | .02 | .02 |
| K | .50 | .10 | .40 | .10 | .07 | .10 |
| L | .53 | .10 | .40 | .07 | .07 | .10 |
| Mean | .78 | .08 | .49 | .08 | .05 | .08 |
| Range | .16-2.77 | .03-.15 | .09-1.73 | .00-.27 | .00-.15 | .00-.30 |
| S.E. | 0.12 | 0.01 | 0.07 | 0.01 | 0.01 | 0.02 |

## Table 18. Extractable Acidity, cmol $kg^{-1}$

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | | | | | | - |
| B | 3.92 | 8.10 | 9.93 | 5.22 | 6.53 | 13.72 |
| C | 15.27 | 7.72 | 16.96 | 5.40 | 4.94 | 12.18 |
| D | .00 | 3.90 | 6.80 | 3.47 | 3.70 | 7.07 |
| E | 3.73 | 4.38 | 9.94 | 5.81 | 2.69 | 14.30 |
| F | 6.00 | 6.20 | 9.40 | 5.00 | 4.20 | 8.60 |
| G | .00 | 4.98 4.83 | 7.39 6.93 | 2.83 3.01 | 3.62 | 10.70 |
| H | | | | | 3.03 | 10.40 |
| I | 3.20 | 8.87 | 10.40 | 6.33 | 6.80 | 14.27 |
| J | .00 | 10.21 | 6.20 | 1.53 | 7.63 | 15.20 |
| K | - | | - | | | |
| L | 6.53 | 8.50 | 13.60 | 8.97 | 7.40 | 13.50 |
| Mean | 3.87 | 6.74 | 9.51 | 4.73 | 5.06 | 11.99 |
| Range | .00-15.27 | 3.90-10.21 | 6.20-16.96 | 1.53-8.97 | 2.69-7.63 | 7.07-15.20 |
| S.E. | 0.82 | 0.41 | 0.67 | 0.49 | 0.37 | 0.56 |

Table 19. CEC, sum of cations, cmol $kg^{-1}$

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | | | | | | |
| B | 61.01 | 10.11 | 44.59 | 6.67 | 7.06 | 14.27 |
| C | 110.32 | 9.91 | 55.29 | 6.71 | 5.40 | 12.60 |
| D | 87.90 | 5.73 | 38.93 | 5.00 | 4.23 | 7.60 |
| E | 48.65 | 5.88 | 26.36 | 6.81 | 3.11 | 14.76 |
| F | 81.70 | 10.40 | 48.60 | 7.17 | 4.77 | 9.47 |
| G | | 6.97 | 39.85 | 4.22 | 4.04 | 11.15 |
| H | 95.33 | 7.23 | 38.27 | 4.37 | 3.53 | 11.03 |
| I | 89.67 | 11.73 | 41.03 | 7.93 | 7.27 | 14.67 |
| J | 98.93 | 11.98 | 27.64 | 2.78 | 8.00 | 15.57 |
| K | | | | - | | |
| L | 72.17 | 10.90 | 45.17 | 10.53 | 8.20 | 15.00 |
| Mean | 81.80 | 9.06 | 40.07 | 6.20 | 5.57 | 12.61 |
| Range | 48.65-110.32 | 5.73-11.98 | 26.36-55.29 | 2.78-10.53 | 3.11-8.20 | 7.60-15.57 |
| S.E. | 3.66 | 0.44 | 1.56 | 0.50 | 0.38 | 0.56 |

Table 20. CEC, $NH_4OAc$, cmol kg -1

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | 54.50 | 5.12 | 31.87 | 3.25 | 2.44 | 3.62 |
| B | 43.27 | 6.07 | 28.13 | 4.20 | 4.27 | 5.40 |
| C | | | | | | |
| D | 54.53 | 5.13 | 35.73 | 4.40 | 3.67 | 5.80 |
| E | 50.69 | 4.79 | 32.36 | 3.83 | 3.15 | 3.49 |
| F | 71.87 | 6.97 | 36.00 | 3.83 | 3.27 | 3.47 |
| G | | 5.43 | 33.00 | 3.01 | 2.41 | 4.65 |
| H | 55.77 | 5.27 | 34.10 | 3.47 | 2.63 | 3.77 |
| I | 63.77 | 6.13 | 39.43 | 3.67 | 2.93 | 5.03 |
| J | 51.54 | 4.13 | 30.87 | 1.63 | 1.29 | .96 |
| K | | | | | | |
| L | | | | | | |
| Mean | 55.80 | 5.45 | 33.50 | 3.48 | 2.89 | 4.02 |
| Range | 43.27-63.77 | 4.13-6.97 | 28.13-39.43 | 1.63-4.40 | 1.29-4.27 | .96-5.80 |
| S.E. | 1.78 | 0.17 | 0.63 | 0.16 | 0.16 | 0.28 |

Table 21. Exchangeable Al, cmol $kg^{-1}$

| Lab | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| A | .00 | .JO | .00 | .24 | .83 | .00 |
| B | .00 | .54 | .01 | .15 | .73 | .00 |
| C | .00 | .30 | .00 | .17 | .04 | .12 |
| D | .00 | | | .33 | .90 | .00 |
| E | .25 | .78 | .23 | .30 | .88 | .13 |
| F | .00 | .57 | .30 | .33 | .70 | .00 |
| G | | .89 | .18 | .39 | .95 | .09 |
| H | .00 | .43 | .00 | .13 | .53 | .00 |
| I | .00 | .53 | .00 | .10 | .63 | .00 |
| J | .00 | .52 | .00 | .21 | .63 | .00 |
| K | .00 | .87 | .00 | .20 | .83 | .00 |
| L | .00 | .60 | .00 | .20 | .70 | .00 |
| Mean | | .62 | .06 | .23 | .72 | |
| Range | .00-.25 | .30-.89 | .00-.30 | .10-.39 | .04-.95 | |
| S.E. | 0.01 | 0.03 | 0.02 | 0.02 | 0.04 | |

Table 22. ECEC, cmol $kg^{-1}$

| Lab | Sample |
|---|---|
| A | |
| B | |
| C | |
| D | |
| E | |
| F | |
| G | |
| H | |
| I | |
| J | |
| K | |
| L | |
| Mean | |
| Range | |
| S.E. | |

Table 23. Base Saturation, %

| Lab | Sample 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | - | - | - | | | |
| B | 93.56 | 19.88 | 77.71 | 21.68 | 7.53 | 3.85 |
| C | 86.00 | 22.50 | 69.00 | 19.50 | 8.50 | 3.00 |
| D | 99.99 | 32.00 | 82.67 | 29.00 | 12.67 | 7.00 |
| E | 92.27 | 25.63 | 62.23 | 14.90 | 14.47 | 3.23 |
| F | 92.63 | 40.37 | 80.67 | 30.23 | 11.83 | 9.10 |
| G | | 28.56 | 81.46 | 28.62 | 10.40 | 4.10 |
| H | 99.99 | 32.67 | 81.67 | 35.00 | 14.00 | 5.67 |
| I | 96.40 | 24.43 | 74.67 | 20.17 | 6.43 | 2.70 |
| J | 99.99 | 14.92 | 80.73 | 66.68 | 4.93 | 2.71 |
| K | - | | | | | |
| L | 90.93 | 22.10 | 69.97 | 18.00 | 9.93 | 9.70 |
| Mean | 94.97 | 26.44 | 76.32 | 28.68 | 10.12 | 5.18 |
| Range | 86.00-99.99 | 14.92-40.37 | 62.23-82.67 | 14.90-66.68 | 4.93-14.47 | 2.70-9.10 |
| S.E. | 0.87 | | | | | |

Table 25. CeC03 Equivalent, %

| Lab | Sample |
|---|---|
| A | 17.00 |
| B | 17.33 |
| C | |
| D | - |
| E | 17.50 |
| F | 16.00 |
| G | - |
| H | 19.67 |
| I | |
| J | - |
| K | 17.37 |
| L | 20.00 |
| Mean | 17.98 |
| Range | 16.00-20.00 |
| S.E. | 0.54 |

Table 26 cont'd.

Sample 3

| Lab | SM | V | HIV | K | MI | GI | Q | GO | CA |
|---|---|---|---|---|---|---|---|---|---|
| Auburn | 48 | | | 24 | | | | | |
| Clemson | 60 | | | 20 | 15 | | | | |
| Florida | 72 | | 16 | 3 | | | 9 | | |
| Georgia | ** | | | * | * | | * | | |
| Kentucky | 50 | | | 20 | 20 | | 5 | 5 | |
| N.C. State | *** | | | * | * | | | | |
| Oklahoma St. | *** | | | * | * | | * | | |
| Texas A&M | *** | | | * | * | | * | | |

Sample 4

| Lab | SM | V | HIV | K | MI | GI | Q | GO | CA |
|---|---|---|---|---|---|---|---|---|---|
| Auburn | | | 25 | 70 | | 4 | | | |
| Clemson | | | 15 | 70 | | 5 | 10 | | |
| Florida | | | 28 | 58 | | | 14 | | |
| Georgia | | | ** | *** | | | * | | |
| Kentucky | | | 25 | 50 | 3 | 5 | a | 7 | |
| N.C. state | | | Not Determined | | | | | | |
| Oklahoma St. | | | ** | *** | | | * | | |
| Texas A&M | | | ** | ** | T | | * | | |

Table 26 cont'd.

Sample 5

| lab | SM | V | HIV | K | MI | GI | Q | GO | CA |
|---|---|---|---|---|---|---|---|---|---|
| Auburn | | | 5 | 75 | | 1 | | | |
| Clemson | | | 5 | 80 | | | | 5 | |
| Florida | | | 7 | 93 | | | | | |
| Georgia | | | * | *** | | | T | | |
| Kentucky | | | 5 | 75 | | | 5 | 5 | |
| N.C. state | | | Not Determined | | | | | | |
| Oklahoma St. | | | | *** | | | | | |
| Texas A&M | | | * | *** | | | T | | |

Sample 6

| Lab | SM | V | HIV | K | MI | GI | Q | GO | CA |
|---|---|---|---|---|---|---|---|---|---|
| Auburn | | | | 76 | | 7 | | | |
| Clemson | | | | 70 | | | | 20 | |
| Florida | | | 4 | 68 | | 10 | 18 | | |
| Georgia | | | | *** | | | T | * | |
| Kentucky | | | 5 | 55 | 7 | 15 | 5 | 10 | |
| N.C. state | | | | *** | | | | | |
| Oklahoma St. | | | | *** | | | | ** | |
| Texas A&M | | | | *** | | | | ** | |

SH-smectite; V-vermiculite; HIV-hydroxy-Al inter-layered vermiculite;

COMMITTEE IV: SOIL WATER, SOUTHERN REGIONAL SOIL SURVEY WORK-PLANNING CONFERENCE OF THE NATIONAL COOPERATIVE SOIL SURVEY.

Charge 1: Keep the Southern Regional Soil Survey Work Group informed of proposals of the International Committee (ICOMAQ) and any related activities within our region.

I. International Activities of ICOMAQ

ICOMAQ circular letter No. 7 dated October 8, 1987 is the latest circular. A copy is attached as Appendix 1. It defines the aquic moisture regime as:

"The aquic moisture regime implies that the soil has experienced periods of saturation and reduction within 50 cm of the mineral soil surface. It is identified by 'diagnostic morphological redox characteristics (mottles) associated with wetness' and/or by measurement of saturation or wetness and reduction."

The terms mottles that have chroma 2 or less, saturation, wet, and reduction are all defined. Also gleyic mottling is defined for soils with groundwater tables. Stasnic mottling is defined for soils with perched water tables. Anthraouic mottling is defined (as a variant of stagnic mottling) for soils reduced due to flooding for rice production.

Gleyic, stagnic and anthraquic would be used at the great group and/or subgroup level.

The following table is from the circular with our interpretation of aquic or nonaquic added.

| Condition | Moisture | Reduction | Mottling | Aquic |
|---|---|---|---|---|
| 1. Groundwater | wet | yes | yes | yes |
| 2. Surface-water (natural & man-induced) | wet | yes | yes | yes |
| 3. Red soil (poorly weatherable) | wet | yes | no | yes |
| 4. High $O_2$ in water | wet | no | no | no |
| 5. Drained by man | moist | no | yes | yes |
| 6. Relict mottling | moist | no | yes | no? |

Classification of the first 4 conditions seems to follow from the definition. Condition 5 would be covered by requiring soils to have aquic moisture regimes or to be "artificially drained."

Condition 6 presents some problem. The circular states "no aquic moisture regime, if they are now moist and non-reducing. The new description in section I covers this condition: mottling alone is not enough!" However, the definition states "diagnostic morphological **redox** characteristics (mottles) associated with wetness and/or . .." It is our interpretation that the "or" in "and/or" is definitive. It thus allows soils to be aquic based on mottling alone.

The circular indicates a workshop is tentatively planned in the USA for 1989. The committee **(ICOMAQ)** hopes to have a complete key ready for testing before the workshop.

II. Activities on the Aquic Moisture Regime Within the Southern (USA) Region.

A **SMSS-ICOMAQ** tour and workshop is presently planned for our region in 1990. It is apparently the same one referred to in the circular as planned for 1989. The tour will start in New Orleans, observe soils (with data) in Louisiana and Texas, and terminate at San Antonio in time for the 1990 meetings of the Soil Science Society of America. The workshop portion would likely be in San Antonio with perhaps some discussion in New Orleans at the start of the tour.

Louisiana and Texas, under the leadership of Wayne H. Hudnall and Larry P. Wilding, are presently selecting sites and installing monitoring in preparation for the tour. There will be about 20 sites within the two states. Data at each or most sites will include (1) a soil description, (2) observations from piezometers, tensiometers, and unlined bore holes, (3) field observations of **pH, redox** from dye tests and from electrodes, and dissolved oxygen content, (4) routine physical and chemical analyses as well as mineralogical and micromorphological analyses, and (5) a **redox** potential study of key horizons of selected soils.

<u>Charae 2</u>: Develop guides for collecting a soil water data base.

The committee is assuming this charge to relate only to <u>free-water</u> and not to unsaturated water contents or rates of water movement.

In order for us all to focus on the same problem, the committee addressed the following objective.

**<u>Objective</u>:** To collect data to characterize the occurrence (frequency, depth, duration, etc.) of free-water within a soil series **<u>and</u>** to relate the occurrence of free-water to soil morphology.

1. Number of locations and number of observations at each location.

   Committee members felt I to 5 locations should be monitored. The most common response was 3 locations. The range and extent of the series should be considered. Some range over several states, but others occur in a limited area.

The number of depths to be monitored depends on the soil. However, most committee members felt that for each depth that was to be monitored, the observation should be replicated 3 times at each location. These replications would normally be within a few meters of each other.

2. Number and detail of soil descriptions.

All members agree that a detailed soil description should be collected from a soil pit at each location. Considerable attention should be given to describing ped interiors and ped exteriors separately. This is especially true when the present proposals of ICOMAQ are considered.

If at a location one were observing the occurrence of free-water at 4 depths and replicating each observation 3 times, 12 installations would be required. Would 12 soil descriptions be required? The answer depends on the variability of the soil. One approach would be to have one description from the pit and a brief description from each installation taken at the time of installation. In more variable soils each installation may need to be dug out and the soil described after completion of the study.

We need to exercise caution not to create false data. If installation holes are dug but not used, they should be refilled with soil and the soil should be packed (assuming an observation is to be made within a few meters). In some cases the hole should be filled with cement or a soil-cement mixture. Also, the pit from which the soil description is taken should be an 'appropriate' distance from the area of observations. In some cases the pit should not be dug until the observations are completed.

3. Frequency and duration of free-water observations.

Most committee members felt that the <u>minimum</u> frequency of observation should be 1 observation per 2 weeks. Essentially, all agreed 1 or 2 observations per week would be better. Three committee members had the good judgement to indicate that the frequency of observation should be related to the frequency of change in depth to the free-water. One member suggested more frequent observations during the fall **wetup** and during the spring when ET became a factor.

Most members thought some short periods of intense observation would be desirable; for example, 1 or 2 observations per day for several days after a few major rains. However, most members recognized that funds would not normally be available for these observations.

The committee felt that observations should be continued for a minimum of 3 years. The need for some long-term, perhaps up to 30 years, observations was also recognized.

4. Collection of rainfall data.

It is becoming quite evident to most committee members that off-site rainfall data is simply not adequate. Although automatic rain gauges cost about $800, we should have them if we are to relate the occurrence of free-water in the soil to rainfall on the soil. However, most members recognized that we probably will continue to use off-site rainfall data due to economics.

Comments:

1. The reader should understand that the above comments are only guides intended to help in starting a free-water monitoring program. Objectives and soils differ, thus the approaches used should differ. One committee member noted that each data collection program should have stated objectives and hypotheses to be tested. He is correct.

2. One committee member indicated that the biggest problem would be bypass flow, flow through macropores which causes the free-water surface to be above the zone of saturation. Another member indicated that all installations should include tensiometers. That should resolve the bypass flow problem.

3. The response on need for replication of an observation at one location was less than unanimous. Restated: if we are to measure the occurrence of free-water above the fragipan at a location, how many observations are needed at that location? Some thought only 1 was needed and some thought 3 were needed. It has been the chair's experience that replicated observations vary quite widely during periods of change in depth to free-water, but the variability decreases when the water table is more 'stable'.

4. One member suggested that we needed observations in cultivated, wooded, and pastured areas for many series. His observations suggest tillage pans may be significantly affecting recharge of soils and, thus, the occurrence of free-water in them.

Recommendations of the committee:

1. The committee should be continued to:

   A. Keep the Work Group advised of the activities of the International Committee on Soils with Aquic Moisture Regimes (ICOMAQ).

   B. Advise the Work Group of activities within the Southern Region which are related to soil water and especially to the aquic moisture regime.

   C. Consider compiling a list of soil features and properties that influence soil-water relationships. (This is a possible charge for a committee regarding soil interpretations.)

   D. Pursue charges deemed appropriate by the Work Group and the incoming Chair.

2. The committee anticipates that computer models will be used to predict the occurrence of free-water in many soils. Long-term data and short-term intense data will be required to build such models. The committee encourages the collection of such data.

3. The committee recommends a coordinated systematic collection of data pertaining to aquic moisture regimes within the Southern Region including development of a list of soils needing data.

Recommendations/comments from the floor:

Joe Nichols recommended that copies of comments sent to Dr. J. Bouma, Chair of the International Committee on the Aquic Moisture Regime (ICOMAQ), be sent to the chair of this committee and that the chair assemble these and send them to interested members of our group. The chair accepted this responsibility provided some comments were received. The chair expressed concern that the aquic moisture regime was quite important to the Southern Region, but we were not sending comments to ICOMAQ.

Committee members:

Richard Babcock
L. C. Brockman
J. L. Driessen
Charles Fultz
Bob Grossman
Bobby Hinton
Wayne Hudnall
David Jones
Ron Paetzold
Dave Pettry
W. E. Richardson
Clyde Stahnke
Robert Stone
Larry Ward
Larry Wilding
Larry West, Vice-Chair
E. Moye Rutledge, Chair

[redacted]

Department of Soil Science and Geology

Agricultural University Wageningen

Your reference
Your letter of
Our reference 7201912 tvh
Enclosure(s)
Date October 8, 1987

Re COMAQ circular letter no. 7.

Dear Colleagues,

I hope you are all ready for ● nothar ● quic ● xarcire. We may face . minor communication gap at this time because only some of you could be in Japan for the IXth Classification Workshop where ● quic moisture regimes were discussed very thoroughly. We had excellent and productive sessions!I like to follow the results from our Japan-discussions from now on, to avoid that we

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1. The aquic moisture regime

The following revised definition of the aquic moisture regime is proposed: "The aquic moisture regime implies that the soil has experienced periods of saturation and reduction within 50 cm of the mineral roil surface. It is identified by "diagnostic morphological redox characteristics (mottles) associated vith wetness" and/or by measurement of saturation or wetness and reduction.'

This definition differ* from the existing on., as follows:

1. Mottles are included in the definition because they or. being observed by soil surveyors to make estimates of the water regime. Long-term records of water table fluctuations are really needed but they are usually not available. To obtain these types of specific data, special projects are needed vhieh go beyond the scope of a normal soil survey project. Use of mottles to predict water regimes certainly has major limitations. However, in many soils they can be a very useful diagnostic tool.
2. A depth of SO cm is proposed to focus the definition on . specific hydrological condition in . soil rather than on . condition of . coil material that can occur at different levels in the soil.

The definition, . . proposed, appears to be meaningful as it integrates the various aspects that are considered when dealing with vet *oils: saturation, reduction/oxidation and mottling. These aspects should be defined specifically. Mottling is considered in section 2. Attention will be confined her. to the characterization

2. <u>Other diagnostic soil characteristics.</u>

<u>Redox characteristics (mottles) associated with wetness</u>
Redox mottles are formed . . . result of reduction end oxidation processes of iron and manganese

soil matrix. Stagnic mottling is associated with the following diagnostic features:

1. Chroma of 2 or less (moist) end value of 4 or more (moist) in a continuous horizon when no macropores • re present and along the walls of macropores, if present, and concentrations of oxidized iron and manganese in underlying soil if no macropores are present or in soil between macropores, if present. Concentrations may be in the form of concretions larger than 2 mm.
2. Chroma of more than 2 in an underlying horizon above a depth of 100 em below surface, indicating lack of saturation.

   Occurrence of . slowly permeable subsoil horizon with . hydraulic conductivity that is lover than precipitation rates and lateral subsurface flov towards the pedon, if present, during the period in which the perched water table occurs.

Anthraquic mottling represents a variant of stagnic mottling and is associated with controlled flooding for wetland rice, resulting in reduction processes in puddled surface

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3. Diagnostic features rather then diagnostic horizon.

Suggestions have been made for defining several new diagnostic horizons, both ● pipedons end subsurface horizons. Because of the occurrence of wet soils in all soil orders, there is . need for flexibility to ● llov for specific expressions of wetness in the different orders. Us. of diagnostic features offers more flexibility then rigid definition of diegnostic horizon. which would be difficult for wet conditions. As an example, one can point to the definition of the mollic horizon which i. highly complex ● v*" though it occurs only in few orders.

The diegnostic

Andisols that are saturated[1] with water at some time of the year of are artificially drained, and that have one or more of the following:

1. A histic epipedon: or

2. At . depth of less than SO cm or immediately below ● n epipedon that his colour values, moist, of 3 or less, dominant colours, moist, on ped faces, or in the matrix if peds are absent, as follows:
   (a) if there is mottling, chroma of 2 or less, or
   (b) if there ii no mottling, chroma 1 or less; or

3: Two percent or more mottles larger than 5 mm due to segregation of iron, as follows:

   (a) Within or immediately below 18 cm of the surface, or
   (b) Within or

| CONDITION | MOISTURE STATUS | REDUCTION | MOTTLING |
|---|---|---|---|
| 1. GROUNDWATER | WET | YES | YES |
| 2. SURFACE-WATER (NATURAL AND HAN-INDUCED) | WET | YES | YES |
| 3. RED SOIL (POORLY WEATHERABLE) | WET | YES | NO |
| 4. HIGH 02 IN WATER | WET | NO | NO |
| 5. DRAINED BY MAN | MOIST | NO | YES |
| 6. RELICT MOTTLING | MOIST | NO | YES |

Condition 3. Red soil (poorly weatherable). Reference is med. to letter 5 with comments by Harner(about Michigan end Wisconsin soils). Definitions presented in this letter in ● ection I ● llov distinction of en equic moisture regime (requiring measurement cf saturation end reduction). Thu., wetness would be distinquished et suborder level, assuming that we require

### III Next phase

After receiving your reactions, we should prepare a tentative key with the associated descriptions of the "aquic moisture regime", and "other diagnostic soil characteristics". This exercise will have to cover virtually all Orders, and is probably the best procedure to arrive at a key that can be tested. Before embarking on this major effort, you should first react to the results of the Japan meeting: the definition of the aquic moisture regime and emphasis on "diagnostic characteristics' such as gleyic and stagnic mottling. Please remember that one major reason for not defining new diagnostic horizons is the fact char aquic phenomena occur in all orders. It would be very difficult to obtain concise, and readable descriptions of diagnostic horizons that cover this large range.

Hope to hear from you. Best wishes.

Sincerely yours,

Johan Bouma

Prof. dr. J. Bouma

# 1988 SOUTHERN REGIONAL SOIL SURVEY WORK PLANNING CONFERENCE

## COMMITTEE V. REPORT: SOIL SURVEY AND MANAGEMENT OF FORESTLANDS


S.Buol
C.Turner
A.Tiarks
L.Chavous
L.Morris
B.Goddard
J.Vann
G.Smalley
E.O'Brien
R.Rightmyer
J.Robins
K.Watterston
R.Peters
P.Kleto


<------------------------------STAND LIFE----------------------------------->

<--------------------Site degradation potentials------------------------->
<--------------------Site improvement potentials------------------------->
<--------------------Productivity------------------------------------------->
<--------------------Changes in water quality----------------------------->
<--------------------Sitting of special areas------------------------------>

In contrast to these suggested interpretations. current interpretations seem to satisfy the needs of the manager of the exploited forest. Respondents to the committee's questionnaire seemed generally dissatisfied with current interpretations. These interpretations are not concerned with providing information needs in the regulated or domesticated forest.

When asked if interpretations currently being made were appropriate a majority said "no". When asked if the level of mapping was suitable most said "no". When asked what kind of mapping was necessary respondents replied "intense Order 2". Users are dissatisfied with most interpretations and believe more accurate and detailed maps are needed for county surveys to meet their needs. Productivity was generally the rating most cited as being inaccurate and the one that was most desired by the users. Other ratings like seedling mortality and equipment limitation were viewed as simplistic.

Management alternatives to overcome limitations and productivity response to management practices were the most desired classes of interpretations absent from survey reports. In order to make interpretations like those listed in the previous table mapping must be detailed.

Foresters are currently using many of these techniques and are using site characteristics to make prescriptions. Industrial or contract soil mappers working with them are currently making maps which are suitable for making these interpretations. Order 2 surveys properly designed for intensive forest management which have a suitable interpretive and mapping reliability can be used for making these interpretations. And, the criteria can be made available for developing these interpretations.

Charge 2. Determine suitable ways to present forestry interpretations in survey reports.

Concerns and opportunities deal primarily with report content, not report format. Specifically, management practices and alternatives to management practices are not being addressed. At present, in map unit descriptions a single statement is used to note suitability for woodland use. Interpretations, including ordination symbol, equipment limitation, seedling mortality. plant competition, selected trees. and site index are included in table format in the appendix close to soil maps.

The soil map unit description should contain the mapping or management concept being interpreted and address suitability to management. The woodland section of Use and Management of the Soils is a more appropriate area to discuss how and for what purpose the interpretations were made.

Interpretations for management practices and alternatives to management practices which are badly needed by managers of woodland areas fall within four stages of forest management: site preparation, stand establishment, stand tending, and harvesting. Management practices and alternatives to management practices should be interpreted for the appropriate stage of forest management.

Recommendations for Charge 1:

A. Each state's work planning group needs to support an Order 2 level of mapping where the major land use is intensive forestry.

B. An interdisciplinary problem solving team should be established as soon as possible to develop interpretations suitable for intensive forest management. It is suggested that a representative of the Society of American Foresters (SAF) soils working group be included with university, federal and state agency, and industry representatives. Interim results should be presented at the national work planning meeting in July of '89. The team should have completed information gathering and be involved in reviewing interpretative criteria by the next work planning conference.

**Recommendations for Charge** 2:

A. Forestry interpretations should be written that address the technical aspects of the land use. Material should be prepared at a level suitable for natural resource professionals (examples: DC, extension agent) but should be comprehensive enough for the practicing forester.

B. The woodland management section of Use and Management of Soils should discuss how and for what purpose interpretations were made for management practices. Management practices should be discussed for site prep. stand establishment, stand tending, and harvesting.

C. Each map unit description should address suitability to management and recommend specific management alternatives to overcome limitations.

D. Soil productivity is the most important property for making management decisions as it drives the economic benefits of forest management. Data collected for site quality while mapping should be published in the soil survey report.

General Recommendations:

A. Use of the discussion groups was effective in soliciting input from session participants. However. more time should be provided for committee interaction.

B. The committee should be continued to review and report on findings of the ID Problem Solving Team for development of woodland interpretations. The committee recommends that Jim Keys, Forest Service, remain as chairman.

Keys

1/

# Soil and Man's Use of Forest Land

E.L. STOKE

IT SEEMS EXCEEDINGLY APPROPRIATE that this fourth quinquennial conference should be held on this impressive campus, in this historic city. Following the beginning of this conference series at Michigan State University. we met at two other universities, in two of the three major wood. growing regions in North America-First at Oregon State Uniwrrity. representing the grand coniferous forests of the Pacific Coast. and then at North Carolina State University. representing the diverse and productive young forests of southern United States. Today we are gathered at yet another distinguished university. from another tradition, in

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E. L. Stone is Charles Lathrop Pack Professor of Forest Soils, Dept. Agronomy, Cornell University, Ithaca, NY 14850. Agronomy Paper No. 1063.

"Soil and Man's Use of Forest Land" was the keynote address at the Fourth North American Forest Soils Conference.

[1] Quoted by Norman Taylor, former director of the New Zealand Soil Bureau.

that have found some common interest in the soil mantle under forest vegetation. At one time or another, anthropologists, chemists, conservationists of all persuasions, ecologists, engineers, geographers, geologists, limnologists, forest

**Table 1.** Synopsis of four models of forest soil.

I. *Soil as a natural body*
- Based on geological origin, geomorphic history, and weathering processes, leading to characteristic morphology and landscape relationships. These set limits to rates of change under management.
- Soil continuum can be classified and mapped at various scales and levels of generalization.
- Usual time scale of interest: 10[illegible] to 10[illegible] years.

II. *Soil as a medium for plant growth*
- Based on functional properties such as anchorage, available moisture, nutrient supplies, rooting opportunities. These properties result from combinations and interactions of measurable feature such as texture, minerology, slope, drainage regime, etc. within particular climates.
- Functional properties meaningful only in terms of known plant responses.
- Usual time scale of interest: 10[illegible] to 10[illegible] years.

III. *Soil as an ecosystem or ecosystem component*
- Based on either flow of chemical elements and energy, or relationships among myriad populations of organisms and roots, or both.
- Energy from net photosynthesis mostly consumed in and on the soil. Decomposition products modify soil development and functional properties.
- Changes in system processes or storage terms influence community response to disturbance or management (e.g. fire or cutting).
- Usual time scale of interest: 10[illegible] to 10[illegible] years.

IV. *Soil as a vegetated water-transmitting mantle*
- Based on infiltration, movement, and storage of water, evapotranspiration, and mantle stability.
- Watershed behavior set by geology and climate, modified by vegetation and treatment.
- Storage, movement, and evapotranspiration set limits on organic productivity, leading to reciprocal effects.
- Usual time scale of interest: 10[illegible] to 10[illegible] years.

of compartment diagrams. "cycles", and Irophic levels. The forester's awareness of nutrient cycles goes back to the work of Ebermayer with litter removal in the German forests just about a century ago. Today. this simple model has broadened IO include many specific aspects of decomposition of organic materials, accumulation and influence of residues, disposition of chemical elements liberated or immobilized by biotic activity, and the transformation of the soil environment itself through this activity. This model generates many hypotheses about how forest management might influence both short and long term forest development. It is also the framework in which to consider the fate and influencer of added pesticides or atmospheric fallout.

The fourth model examines the soil mantle us one portion of the grand hydrological cycle. Climate and geology set limits on watershed behavior. But within these the soil absorbs, stores, and transmits water, and so determines the amount, rate, and quality of runoff. The physical attributes of soil and landscape arc paramount fixed properties of the system. Vegetation is the major variable. acting through its withdrawal of soil water, and its profound effects on soil porosity and stability. This model is joined to the second model through a reciprocal concern with rooting depth and water usc by trees.

But these features arc not to be understood in isolation. Over much of the land classified as forest, vegetation is being altered by harvest, or by other user and catastrophes. Disturbances of the soil surface, including road construction, often accompany these Therefore one emphasis of this model is a capacity to predict, control. or make usc of the consequences of vegetational treatment in man's interests.

Some may wonder at the lack of a fifth model centered on the georechnic or engineering aspects of soil. Though warranted. such a model would extend beyond the usual expertise of soil scientists. Moreover. the environmental effects of soil disturbance are readily dealt with through the watershed model.

Having Ibis rough structuring of fores1 soil science in mind. let us turn to the forest land management systems of the present day and immediate future. Many of us have struggled to rationalize the bewildering diversity of forest treatments in North America for our students or visitors from abroad. We find that the classical notions of "intensive" und "extensive" management often fail IO describe the actual range and combinations that exist in different parts of the continent. or even in nearby tracts within the same fores1 type. And we see that scientists who attempt to generalize from observations within a single management system sometimes suffer from a similar confusion.

Thus. it may be useful IO represent forest management in North America us a spectrum of managerial purposes combined with Ihc levels of skill and physical input involved (Fig. 1). This wide range is. of course. the product of political. economic and technological forcer acting upon the original forest resources. We could say much more about these and their possible impacts in the future. But for the present, we are concerned only with the existence of such a spectrum and any likely shifts within it in the very near future. For this is the immediate setting in which any applications of soil science to forest land use will be made.

What I have termed the *regulated forest* is familiar to all of us as the managed forest of the silvicultural textbooks, and so it is a convenient starting point. In North America. this

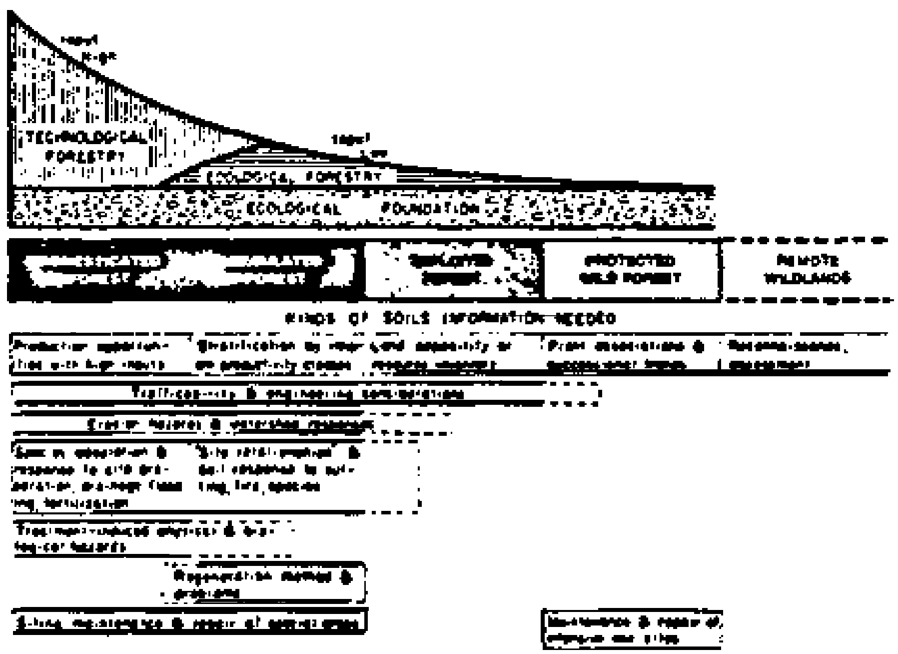


FIGURE 1. Schematic spectrum of the levels of managerial purpose, skills and physical input in North American forests, and the associated kinds of soil-related information required for management

other goods and services

industrial *forest* owners, particularly in the U.S., have already decided that efficient production of future wood requires such management. Fully one-third or more of our conference papers deal specifically with this kind of forestry.

But we must acknowledge two reservations: First, many foresters and biologists doubt the eventual wisdom or success of what I have termed the domesticated forest. Some doubts spring from an intuitive distrust of simplicity, artificiality, and technology replacing the greater diversity, "naturalness", and regard for ecological constraints that characterize most of the regulated forest. H. C. Dawkins' (2) question (in a different context) of whether the forest is to be factory or habitat also troubles many. Other doubts reflect the belief that intensified culture necessarily brings intensified pollution. Still another source of doubt is the contrast between the large capital investments involved and the cumulative risk attending the culture of a long-term crop by a technology that is not yet proven by time. It is easy to speculate that new, genetically improved trees may be attacked by new, genetically improved pests, or that soil improvement may be countered by soil impairment. In either case, the forester would lack the capacity of the agriculturist for quick adjustments of crop and culture.

I believe that the thoughtful forest soil scientist must anticipate and deal honestly with the bases of such doubts, so far as they fall within his competence. Several of the conference paper titles suggest that this is being done.

The second and rather evident reservation is that the domesticated forest can make up no more than some modest fraction of the total forest area. Great portions of this total are excluded by climatic or soil restrictions that greatly limit response to higher inputs. Primacy of non-timber values, lack of investment capital, and other causes further diminish the area available for high-input management aimed at wood production. Thus, the factory versus habitat dilemma applies only to some lands and some regions.

I myself am convinced that the domesticated forest and its various intergrades will contribute greatly to future wood supplies, at least in the U.S. But it would be unfortunate if enthusiasm for site preparation, drainage, fertilization, pollution control, and other tangible manipulations deflected attention and research from the far larger land areas that lie in other parts of the management spectrum. Most of the regulated and exploited forests must continue to supply wood and, moreover, with less hazard to soil and water resources than sometimes in the past. Many parts of the whole spectrum are critical to water regulation, and many parts must cope with increasing recreational demands that range from wilderness to wildlife management to ski centers. Yet, over much of this enormous area we are only now inventorying soil resources, and often we know little abou processes and capabilities in districts remote from research centers. If my perception of the management spectrum is at all correct, we must conceive of a structure of soil informslion needs. related to different parts of this spectrum. as well as to our models of the forest soil. Figure I suggests such a structure as a generalized scheme. The reader must supplement this wilh awareness of both the specialized needs for steeplands, wetlands, or other sensitive areas. however. and of the map scales and levels of detail that are feasible.

Rational use of soil resources requires classification. inventory. and appraisal at some appropriate scale. Certainly, no one methodology is appropriate to lhe wide range of mapping detail imposed by available resources. and to the kinds and accuracy of the interpretations required for management in different parts of the spectrum. Several of our conference papers treat this subject. All workable systems of classification draw upon lhc insights of our first model of the soil.

Similarly. a concern with trafficability and road construction extends across all forms and intensities of management except in roadless wilderness areas.

In lhe wild forest. there is little opportunity IO influence water quality or watershed behavior except through lhc impact of roads and campgrounds in some parks. In the exploited forest, such mailers have been largely ignored in the past. Now. however. water quality and watershed protection have become significant public concerns, and the needs for prediction and control of soil response increase more or less in proporlion IO the extent of disturbance and use of chemical inputs. Engineering difficulties and erosion hazards in steepland forests make particularly acute demands on our very limited stock oi information.

In the regulated forest, the manager makes use of an array of "site relationships" that incorporate interactions between soil. climate, and vegetation. He intends lo avoid or minimize productivity losses on susceptible soils, and he must insure regeneration of desired species so far as available resources permit. If information about soils is lo be useful IO him, it must be placed in these contexts and adapted to lhc scale of his management operations.

In contrast, in the domesticated forest. the greater physical inputs available often permit or compel the manager lo circumvent some ecological constraints. Responsiveness lo specific soil treatment is now a major ilem of needed informalion. So also, though the manager may not at once perceive il. is any likelihood of reduction in or hazard IO productivity, especially that arising as a side-effect of such treatments. The high values involved demand accurate appraisals and diagnoses. Such needs, together wilh the frequent

SOIL AND LAND USE

# Minesoil Classification Committee

Report to the Southern Soil Survey Work Planning Conference

Knoxville, Tennessee

June 13 through June 17, 1988

Committee Members: J. T. Ammons, Glenn E. Kelley, Arville Touchett, Horace Smith, David E. Pettry, Glenn Hickman, D. E. Lewis, Jr., Glenn Hicks, Jimmie Frie, Joe Nichols, and John Metz.

Committee Charge: The charge of the committee was to solicit comments from the conference members on how to map and classify disturbed soils.

Summary of comments from conference members:

Mapping minesoils at the family level of soil taxonomy using proposed minesoil taxonomy

Many members of the conference felt that mapping at the family level was suitable. The series level is too broad to make a map with sufficient detail. One reason for the use of the series is that the SCS form 5 can only be used for series interpretations and not for the family.

Series verses family

Many valid points were voiced for use of family and series. Where the overburden is homogenous, the use of series is successful. An example is Eastern Texas where 10 minesoil series are being used routinely to inventory mined land. But other states indicate that use of family criteria with form 5's developed at the amily level would be more useful. The type of mining and the overburden will control the level of taxonomy used. The level of mapping should not be forced to the series or the family level but to the level of taxonomy that best describes the condition of the mined land for the best use of the map.

Udorthents verses Spolents

The present definitions of udorthents do not adequately define the properties present in minesoils. Minesoil properties have been consistently identified and should be defined in a separate suborder whether as Spolents or as part of a new Great Group with the rewriting of the Entisol Order. This will allow the movement of the moisture regimes to the suborder level in Entisols thus allowing a place in soil taxonomy for disturbed soils.

Region and type of mining

The Southeast is a broad region and physiographically, quite diverse. Different ranges in physical and chemical properties will be encountered. For this reason, a definite set of criteria needs to be adopted to insure uniformity in evaluation of minesoils.

Applications outside of surface mining for coal

Deep earth excavations involving movement and deposition of material by machines results in the same properties encountered in minesoils. A disturbed soil taxonomy should have applications to disturbed soils resulting from large civil works projects, highway construction end ancient agricultural terraces. As was suggested in the conference, a" application of proposed taxonomy to old agricultural terraces in China would be appropriate. Such an application to agricultural terraces in Easter" Crete is currently underway.

Direction of the committee

A cooperative venture with the regional committee on surface mine reclamation should be pursued to evaluate mapping minesoils using proposed taxonomy. A" evaluation of sites across the region is in order. After this evaluation, a decision can be reached by the Southern Region on inventory of minesoils. All previous information on the classification should be pooled and evaluated by the minesoil committee before this evaluation is initiated.

Conclusions

A definite need exists to study and map the properties of disturbed soils. Most conference participants support this direction. A" orderly path of reviewing research reports on minesoil properties with review of proposed taxonomic systems will guide the region to the best possible solution to inventory disturbed soils. Results of these studies can then be applied to field mapping conditions to arrive at the best system to inventory disturbed soil properties for use and management.

## Business Meeting - Darwin L. Newton Presiding

Wayne Hudnall read a resolution noting the contributions Dr. B. J. Miller, Professor, Department of Agronomy, Louisiana State University, Baton Rouge, Louisiana, deceased, had made to the Cooperative Soil Survey effort in the United States. The group voted to place this resolution in the published proceedings of this conference.

Gilberto Acevedo extended an invitation to the conference participants for Puerto Rico to host the 1990 meeting. The group voted to accept the invitation.

The group voiced a commendation to Darwin Newton and Dr. Tom Ammons for the excellent work put forth as hosting the 1988 meeting.

Locations for biannual meetings of the Southern Regional Work Planning Conference of the Cooperative Soil Survey.

| YEAR | LOCATION |
|---|---|
| 1988 | Knoxville, TN |
| 1986 | Lexington, KY |
| 1984 | El Paso, TX |
| 1982 | Orlando, FL |
| 1980 | Oklahoma City, OK |
| 1978 | Jeckyl Island, GA |
| 1976 | Jackson, MS |
| 1974 | Mobile, AL |
| 1972 | Blacksburg, VA |
| 1970 | Baton Rouge, LA |
| 1968 | Clemson, SC |
| 1966 | Lexington, KY |
| 1964 | College Station, TX |
| 1962 | St. College, MS |
| 1960 | Stillwater, OK |
| 1957 | Fayetteville, AR |
| 1956 | Raleigh, NC |
| 1955 | Knoxville, TN |

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Conference of the National Cooperative Soil Survey

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NATIONAL COOPERATIVE SOIL SURVEY

Southern Regional Conference Proceedings

Lexington, Kentucky
June 9-13, 1986


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# PROCEEDINGS
# OF SOUTHERN REGIONAL TECHNICAL
# WORK-PLANNING CONFERENCE
# OF THE
# NATIONAL COOPERATIVE SOIL SURVEY

Lexington, Kentucky

June 9-13, 1986

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

K Karathanasis

Tasos Karathanasis

Chairman

Southern Regional Technical Work Planning Conference
of the
National Cooperative Soil Survey

Lexington, Kentucky
June 9-13, 1986

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## INTRODUCTION

The purpose of the Southern Regional Technical Work-Planning Conference is to provide a forum for Southern States representatives of the National Cooperative Soil Survey and invited participants for discussing technical and scientific developments pertaining to soil surveys. Through conference discussions and committee actions current issues are addressed, new ideas are exchanged and disseminated, new procedures are proposed, new techniques are tested, and conventional methods and materials are evaluated. Sharing individual experiences related to soil survey increases the participants proficiency in these research and teaching programs. Conference reconendations and proposals are forwarded to the National Technical Work-Planning Conference. Thus, the results form a basis for new or revised National Soil Survey policy or procedures, or both.

## THURSDAY, June 12

8:00 a.m. **Committee Meetings (4, 5 & 6)**

11:30 Lunch

12:25 p.m. **Agency Meetings**
*Joe Nichols. Jack Perkins*

2:45 *Break*

*William H.* Craddock, moderator

3:05 **National Technical Center Support to Soil Survey**
*Jerry Lee,* Director, SNTC, SCS

3:30 **Soil Taxonomy Committee Report**
*John Witty, Joe Nichols*



## FRIDAY, June 13

*H. H. Bailey,* moderator

8:00 a.m. **Committee Reports** (15 min. each)

9:30 Break

9:45 **Business Meetings**

10:45 - 11:30 **Closing Comments**
*H. H. Bailey*
*Joe Nichols*
*D. hf. Gossett*

# Southern Regional Technical Work Planning Conference of the Cooperative Soil Survey


**Lexlngton. Kentucky**
**June g-13.1986**

## MONDAY, June 9

*A.D. Karathanasis. moderator*

9:00 a.m. Registration

1:30 p.m.

1:45

*Randall W. Giessler*
State Conservationist, USDA-Soil Conservation Service, Lexington, KY

*Charlotte, Baldwin*, Secretary
Kentucky Natural Resources & Environmental Protection Cabinet
Frankfort, KY

*Richard Wengert*, Forest Supervisor
Daniel Boone National Forest, U.S. Forest Service, Winchester, KY

2:40 **Kentucky's Land and Soil Heritage**
*Glenn E. Kelley*

3:00

3:20

*Richard Arnold*, Director
Soil Survey Division, USDA-Soil Conservation Service, Washington, DC

*Ed Thomas*, Assistant Chief, South
USDA-Soil Conservation Service
Washington, DC

4:30

5:30

**National Soil Survey Laboratory Activities**
*Warren Lynn*, South Representative

**GIS Support to Soil Survey**
*Patricia Daugherty*, Tennessee Valley Authority, Norris, TN

*Steve Coleman*, Division of Conservation, Kentucky Natural Resources and Environmental Protection Cabinet

**Soil Survey Research Coordination**
*Ellis Knox*, SCS, Washington, DC

**International Committee Activities**
*Joe Nichols*

**Committee Meetings (1, 2 & 3)**

Barbecue
Horse Park party barn

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## CARTOGRAPHIC SUPPORT OF SOIL SURVEYS

The National Cartographic Center, Fort Worth, Texas, helps to support the soil Survey program as follows:

(1) Obtaining imagery - mapping and publication
(2) Preparing photobases and related overlays
(3) Preparing final publication negatives
(4) Preparing General Soil and Index Maps and block diagrams

In addition to the above, Cartographic sends and retrieves materials from the Federal Record Centers, prints interim copies of map sheets, prepares photographic enlargements of map sheets and prepares duplicate line negatives of soil information.

Cartographic re-entered the arena Of contracting for map finishing during FY86. To date we have contracted five jobs. Another four jobs will be contracted by the end of June, 1986. We expect this effort to grow, especially as state budgets are cut. Two full-time positions are presently working in contract map finishing.

### Obtaining Imagery

Most of the imagery is obtained from two main sources:

(1) ASCS, Salt Lake City, UT - NHAP-B&W-CIR
(2) USGS - Orthophotography

The average cost of a Survey covered by WRAP-B&W-CIR stereo is $3250.00. Imagery generally will not be ordered until complete county coverage is obtained, because ASCS will not prepare control on partial county coverage. The average turn-around time for NHAP is 2 to 3 months.

USGS orthophotoquads now cost $60.00 each for reproducibles, $750.00 each for newly constructed quads.

The average eastern county takes approximately 15 orthoquads. The average western soil survey area takes approximately 60 orthoquads.

The time required to obtain orthophotography ranges from five months (for reproducibles) to three-plus years (for new construction of orthos).

Due to the cost of getting ground Control, USGS prefers to work a block of several counties at one time, rather than a single county. We are very dependent on their scheduling.

## Preparing Photobases

This section has the greatest number of workers assigned to it and has produced the greatest number of jobs of all the sections in the NCSS Branch. Ideally, we would like to have six months from the acquisition of imagery until shipment of photobases to the state,

This year we will have a drop in production from 126 jobs (FY85) to approximately 90 jobs. This is happening because we have worked through a backlog of partially completed jobs which were transferred to Fort Worth during Cartographic consolidation and we are now working with imagery that has recently been acquired. In future years, the photobase production may drop to 50 or 60 jobs per year, depending on imagery acquisition.

## Negative Prep

Production of press negatives for soil survey publication has been the most consistent at approximately 80 jobs per year for the past four years.

Since January, 1984, we have limited the review of final overlays to a ten percent sample, and we are calling attention only to soil related errors and quality of linework.

We are still receiving about 90 to 95 jobs per year into cartographic for production of final negatives. At present, we have 165 jobs in cartographic to be worked.

The highest priority jobs for negative prep are those that have the text ready. Each month we get an update from Pat Looper, NHQ Publications Branch. We work those jobs first which have or will have, according to Looper, the text ready within three months. This coordination allows some jobs to move through cartographic quickly while others remain in cartographic for a much longer period of time. Fifty-nine jobs have been in cartographic over a year, awaiting completion of the text.

## CONTRACT MAP FINISHING

The following is a list of jobs that are presently in Cartographic:

| Name | No. Sheets | Low Bid | Cost/Sheet |
|---|---|---|---|
| 1. Grant & Hardy Cos., WV | 68 | $9962 | $147 |
| 2. Guam | 15 | 1478 | 99 |
| 3. Avoyelles Pa., LA | 48 | 8928 | 186 |
| 4. Box Elder, UT | 75 | 9750 | 130 |
| 5. Greensville Co., VA | 39 | 6072 | 156 |
| 6. Sullivan Co., NY | 124 | | |
| 7. Ellsworth Co., KS | 56 | | |
| 8. Pangvitch Ar., UT | 34 | | |
| 9. Concordia Pa., LA | 45 | | |
| 10. Gaston Co., NC | 8 | | |
| 11. Williamsburg Co., SC | 76 | | |
| 12. Orangeburg Co., SC | 88 | | |
| 13. Fremont Ar., WY | 274 | | |
| 14. St. Tammany Pa., LA | 72 | | |
| 15. St. Bernard Pa., LA | 81 | | |
| 16. Tangipahoa Pa., LA | 65 | | |
| 17. Natchitoches Pa., LA | 104 | | |
| 18. Dorchester Co., SC | 55 | | |
| 19. San Juan Ar., UT | 78 | | |
| 20. Allen Co., KY | 31 | | |

## NCSS PRODUCTION

| | | FY83 | FY84 | FY85 | FY86 (thru May |
|---|---|---|---|---|---|
| NO. of Aerial Surveys Ordered | NHAP - | — | 56 | 65 | 27 |
| | OR - | -- | 46 | 44 | 10 |
| | | -- | 102 | 109 | 37 |
| No. of Photobase Jobs to State | | 66 | 147 | ~~123~~ 126 | 47 |
| No. of Surveys to Printer | | 78 | 72 | 81 | 41 |

CHARACTERIZATION PROJECTS
IN
NATIONAL SOIL SURVEY LABORATORY DATA BANK
JUNE 1986

SOUTH REGION

************** DATA YEAR ****************************** LISTING DATE 06/05/36

| N S S L  P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| MOBILE COUNTY | RP78AL005 | 78P 3 | 10- 10 | 88- 94 |
| TUSCALOOSA COUNTY | RP78AL025 | 78P 16 | 76- 79 | 403- 439 |
| JEFFERSON AND SHELBY COUNTIES | RP78AL026 | 78P 17 | 80- 82 | 440- 446 |
| COVINGTON COUNTY | RP78AL070 | 78P 36 | 160- 160 | 844- 847 |
| CHOCTAW, CONCUH AND MONROE COUNTIES | RP78AL082 | 78P 43 | 179- 181 | 936- 943 |
| ARUNDEL SERIES STUDY | RP78AL107 | 78P 55 | 252- 256 | 1256-1270 |
| COLE DETERMINATIONS-CECIL & RELATED S | RP78AL125 | 78P 65 | 330- 335 | 1764-1776 |
| MONROE & WILCOX COUNTIES CITRONELLE S | CP78AL186 | 78P100 | 494- 497 | 2857-2891 |
| MONROE COUNTY AL RIV. TERRACE-CITRONE | CP79AL222 | 79P 87 | 353- 358 | 1852-1904 |
| NSSL SAMPLE LIBRARY | CP80AL030 | 80P 14 | 46- 46 | 187- 189 |
| PIKE AND WALKER COUNTIES | RP81AL164 | 81P 79 | 331- 333 | 1715-1720 |
| MACON AND MONTGOMERY COUNTIES | CP81AL175 | 81P 85 | 358- 361 | 1883-1914 |
| WILCOX COUNTY | CP81AL176 | 81P 86 | 362- 365 | 1915-1948 |
| HENRY CO. EROSIONAL SURFACE STUDY | CP81AL284 | 81P150 | 720- 721 | 4318-4338 |
| ALABAMA RIVER TERRACE | CP82AL142 | 82P 71 | 396- 400 | 2023-2073 |
| BULLOCK CO | RP85AL251 | 85P162 | 829- 834 | 4462-4496 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L  P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| TYPE LOCATION CHARACTERIZATION | CP79AR131 | 79P 48 | 152- 159 | 754- 810 |
| CLARK COUNTY | RP80AR132 | 80P 59 | 193- 196 | 975- 988 |
| CLAY, FULTON & IZARD COS. | CP80AR249 | 80P 95 | 364- 367 | 1914-1943 |
| ARKANSAS DELTA | CP84AR143 | 84P105 | 549- 555 | 2995-3053 |
| GARLAND CO | CP84AR207 | 84P143 | 716- 718 | 3951-3966 |
| GARLAND CO | CP84AR226 | 84P157 | 799- 802 | 4527-4544 |
| BULK DENSITY | RP85AR021 | 85P 10 | 58- 70 | 302- 353 |

************** DATA YEAR ****************************** LISTING DATE 06/05/36

| N S S L  P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| CROP EVALUATION RESEARCH | CP81FL208 | 81P101 | 456- 459 | 2617-2639 |
| ARS-GAINSVILLE | RP82FL245 | 82P132 | 814- 814 | 4180-4187 |
| DADE CO | CP85FL194 | 85P132 | 676- 683 | 3488-3520 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N_S_S_L___P_R_O_J_E_C_T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| COLE DETERMINATIONS-CECIL AND RELATED | RP78GA138 | 78P 73 | 367- 371 | 2000-2009 |
| LONG COUNTY | RP79GA139 | 79P 51 | 173- 179 | 867- 887 |
| CARNIGIE SERIES | RP79GA157 | 79P 57 | 193- 196 | 970- 982 |
| COASTAL PLAIN PROJECT, VIRGINIA-GEORG | CP80GA163 | 80P 62 | 202- 205 | 1027-1085 |
| BENCHMARK SOILS-DAVIDSON SERIES | CP80GA273 | 80P109 | 417- 419 | 2249-2265 |
| NATIONAL SOIL MOISTURE STUDY | RP81GA079 | 81P 31 | 135- 146 | 690- 737 |
| FLOODPLAIN STUDY | CP81GA103 | 81P 47 | 193- 201 | 996-1035 |
| BENCHMARK SOIL STUDY | CP81GA215 | 81P104 | 465- 467 | 2664-2684 |
| TIFT AND TURNER COUNTIES | CP81GA291 | 81P156 | 768- 773 | 4568-4611 |
| NSSL SAMPLE LIBRARY | CP82GA087 | 82P 43 | 231- 235 | 1203-1217 |
| ORANGEBURG BENCHMARK SOILS | CP83GA008 | 83P 7 | 36- 38 | 152- 165 |
| QUARTZOSE, IGNEOUS AND FRAGIC SOILS | CP83GA125 | 83P 81 | 440- 447 | 2003-2059 |
| DECATUR, GRADY, OGLETHORPE AND MURRAY | RP83GA226 | 83P126 | 744- 756 | 3703-3748 |
| FACEVILLE & PELHAM BENCHMARK SOILS | CP83GA230 | 83P128 | 759- 764 | 3751-3782 |
| CASOOSA-JASPER COS | RP84GA105 | 84P 74 | 374- 379 | 1986-2005 |
| PINE MOUNTAIN | CP84GA125 | 84P 91 | 465- 473 | 2467-2551 |
| BLADEN BENCHMARK | CP85GA033 | 85P 20 | 161- 164 | 775- 799 |
| GLASCOCK-MARION COS | CP85GA281 | 85P184 | 955- 951 | 5100-5119 |
| GROUNDWATER RECHARGE | CP86GA055 | 86P 31 | 177- 184 | 1090-1142 |



************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N_S_S_L___P_R_O_J_E_C_T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| MINERALOGY SAMPLES | RP78KY014 | 78P 10 | 44- 53 | 300- 311 |
| SPECIAL MINERALOGY | RP79KY105 | 78P 54 | 247- 251 | 1246-1255 |
| MONTGOMERY AND SIMPSON COUNTIES | RP80KY143 | 80P 60 | 195- 198 | 989-1018 |
| CROP EVALUATION STUDY | CP81KY050 | 81P 17 | 73- 77 | 378- 407 |
| CROP EVALUATION RESEARCH | CP81KY082 | 81P 33 | 148- 152 | 747- 778 |
| HENRY, MASON AND TRIMBLE COUNTIES | RP81KY151 | 81P 69 | 300- 302 | 1537-1564 |
| PIKE COUNTY | CP82KY192 | 82P 97 | 574- 591 | 2935-3044 |
| JACKSON OWSLEY AND WAYNE COS. | RP82KY219 | 82P115 | 692- 707 | 3661-3706 |
| PIKE COUNTY | CP83KY195 | 83P110 | 642- 651 | 3159-3221 |
| PIKE COUNTY | [illegible] | 83P113 | 664- 674 | 3274-3315 |
| ALLEN, CRITTENDEN AND PIKE COUNTIES | CP83KY217 | 83P119 | 686- 705 | 3369-3498 |
| PIKE COUNTY | RP83KY253 | 83P143 | 836- 836 | 4230-4234 |
| HART AND MARION COUNTIES | RP83KY272 | 83P157 | 891- 903 | 4563-4595 |
| BELL-HARLAN COUNTIES | CP84KY161 | 84P113 | 600- 611 | 3354-3408 |
| BELL-HARL | CP86KY022 | 86P 12 | 52- 54 | 248- 266 |
| HARLAN-BELL COS | RP86KY023 | 86P 13 | 55- 61 | 267- 294 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| MOREHOUSE PARISH | CP78LA135 | 78P 13 | 357- 361 | 1904-1967 |
| ST. LANDRY PARISH | CP80LA077 | 80P 39 | 171- 176 | 598- 652 |
| BOWIE-MALBIS STUDY | CP80LA298 | 80P123 | 506- 514 | 2838-2913 |
| GREEN-SAND STUDY | RP81LA135 | 81P 61 | 274- 274 | 1421-1426 |
| BOWIE-MALBIS STUDY-SATELLITE SAMPLES | RP82LA098 | 82P 49 | 273- 280 | 1454-1477 |
| BOWIE-MALBIS STUDY--SATELLITE SAMPLES | RP82LA140 | 82P 70 | 384- 395 | 1998-2022 |
| BOWIE-MALBIS STUDY SATELLITE SAMPLES | RP82LA200 | 82P100 | 599- 600 | 3103-3106 |
| RED IRONSTONE SOILS STUDY | CP83LA034 | 83P 26 | 150- 151 | 663- 676 |
| CROWLEY STUDY | CP83LA035 | 83P 27 | 152- 155 | 677- 713 |
| CALDWELL-LASALLE PAR | CP85LA024 | 85P 12 | 81- 86 | 387- 438 |
| LA - CALDWELL - PAR - BUSSY | RP85LA025 | 85P 13 | 87- 87 | 439- 440 |
| CALDWELL PARISH | CP85LA228 | 85P142 | 751- 751 | 3967-3972 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| BULK DENSITY-WATER RETENTION | CP80MS236 | 80P 90 | 334- 342 | 1732-1781 |
| CROP EVALUATION RESEARCH | CP81MS144 | 81P 65 | 290- 294 | 1485-1511 |
| BENCHMARK SOILS | CP81MS245 | 81P121 | 554- 561 | 3272-3316 |
| PANOLA COUNTY | CP81MS306 | 81P165 | 840- 846 | 5047-5109 |
| PANOLA COUNTY | CP83MS052 | 83P 40 | 232- 235 | 1063-1090 |
| ARS-ERODED AGGREGATE | RP84MS121 | 84P 88 | 453- 453 | 2412-2415 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| COLE DETERMINATIONS-CECIL AND RELATED | RP78NC118 | 78P 61 | 314- 318 | 1683-1687 |
| CRAVEN COUNTY | CP78NC152 | 78P 84 | 407- 408 | 2240-2255 |
| CABARRUS COUNTY | CP78NC183 | 78P 99 | 492- 493 | 2848-2856 |
| LENOIR COUNTY | IP80NC008 | 80P 2 | 2- 2 | 4- 8 |
| AYCOCK STUDY | RP80NC012 | 80P 5 | 5- 7 | 19- 27 |
| PORTER STUDY | RP80NC021 | 80P 10 | 40- 42 | 166- 172 |
| HYDE AND TYRRELL COUNTIES | CP80NC201 | 80P 70 | 248- 249 | 1349-1357 |
| COASTAL PLAIN STUDY (NC-SC) USGS | CP80NC295 | 80P120 | 483- 490 | 2690-2754 |
| BRUNSWICK COUNTY | RP80NC299 | 80P124 | 515- 516 | 2914-2917 |
| LEE COUNTY-TRIASSIC BASIN | CP81NC267 | 81P137 | 635- 648 | 3770-3866 |
| CROP EVALUATION RESEARCH | CP81NC300 | 81P160 | 789- 792 | 4695-4718 |
| TRIASSIC BASIN STUDY | CP82NC111 | 82P 56 | 312- 319 | 1605-1552 |
| TRIASSIC BASIN-SODIUM STUDY; MOORE CO | CP83NC148 | 83P 92 | 544- 550 | 2579-2633 |
| JOHNSTON CO | CP84NC194 | 84P135 | 693- 693 | 3826-3839 |
| TRIASSIC BASIN | RP84NC199 | 84P139 | 701- 710 | 3870-3921 |
| PENDER CO | CP85NC055 | 85P 33 | 207- 207 | 1066-1071 |
| NC MOUNTAIN SOILS | CP85NC171 | 85P121 | 627- 637 | 3223-3295 |
| NORTHAMPTON CO | CP86NC165 | 86P105 | 485- 486 | 2887-2903 |



************** DATA YEAR ****************************** LISTING DATE 06/05/86

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| LAJAS VALLEY | CP81PR160 | 81P 75 | 315- 324 | 1616-1691 |
| SMSS-BENCHMARK SOIL | CP82PR253 | 82P136 | 820- 821 | 4216-4228 |
| NSSL SAMPLE LIBRARY | CP84PR085 | 84P 62 | 309- 311 | 1620-1623 |
| CARIBBEAN NF | CP86PR072 | 86P 42 | 222- 227 | 1318-1359 |
| CARIBBEAN | RP86PR075 | 86P 44 | 232- 239 | 1385-1401 |
| CARIBBEAN NF | RP86PR079 | 86P 47 | 250- 259 | 1444-1488 |
| CARI3BEAN AREA | CP86PR110 | 86P 61 | 298- 307 | 1755-1830 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| COLE DETERMINATIONS-CECIL & RELATED S | RP78SC127 | 78P 66 | 336- 339 | 1777-1784 |
| WILLIAMSBURG COUNTY | RP80SC260 | 80P100 | 387- 390 | 2091-2109 |
| HORRY COUNTY-USGS COASTAL PLAIN STUDY | CP82SC074 | 82P 36 | 191- 200 | 1028-1100 |
| ARS-SOIL STRENGTH STUDY-SPIVEY | RP82SC086 | 82P 42 | 222- 230 | 1179-1202 |
| ARS-SOIL STRENGTH STUDY-SPIVEY | RP82SC161 | 82P 78 | 437- 450 | 2213-2229 |
| ARS-SOIL STRENGTH STUDY-SPIVEY | RP82SC180 | 82P 89 | 511- 514 | 2590-2593 |
| BEAUFORT AND FLORENCE COUNTIES | CP83SC069 | 83P 51 | 285- 287 | 1270-1283 |
| WILLIAMSBURG COUNTY | CP83SC207 | 83P114 | 675- 675 | 3316-3323 |
| GEORGETOWN CO | CP84SC133 | 84P 98 | 527- 527 | 2901-2903 |
| NOBOCO SERIES | CP85SC156 | 85P112 | 605- 606 | 3134-3146 |
| CHESTER | CP85SC236 | 85P150 | 772- 773 | 4086-4098 |
| AILEY-HOUZON | CP86SC149 | 86P 90 | 401- 404 | 2363-2391 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| UNICOI COUNTY | RP78TN054 | 78P 32 | 144- 148 | 756- 774 |
| CROP EVALUATION RESEARCH | CP81TN145 | 81P 66 | 295- 297 | 1517-1527 |
| BEDFORD CO | CP85TN046 | 85P 27 | 102- 105 | 909- 930 |
| SUMNER CO | RP85TN080 | 85P 49 | 273- 274 | 1306-1318 |
| BLEDSOE CO | CP85TN117 | 85P 80 | 427- 441 | 2115-2170 |
| ARCHEOLOGICAL SITES | CP85TN211 | 85P137 | 717- 719 | 3700-3718 |
| WESTERN AREA | CP86TN036 | 86P 20 | 110- 122 | 749- 781 |

************[redacted] DATA YEAR *************************************** LISTING DATE 06/05/86

| S S L P R O J E C T NAME | NUMBER | PROJECT | CONSECUTIVE NUMBERS PEDON | SAMPLE |
|---|---|---|---|---|
| VERTISOL ST[redacted] | CP78TX001 | 78P 1 | 1- 8 | 1- 74 |
| WASHINGTON [redacted] TY | RP78TX007 | 78P 4 | 11- 13 | 95- 104 |
| SOUTH TEXAS[redacted] ) SHEET | CP78TX012 | 78P 9 | 43- 43 | 294- 299 |
| SOUTH TEXAS[redacted] ) SHEET | CP78TX089 | 78P 49 | 206- 208 | 1034-1074 |
| VAL VERDE C[redacted] | RP78TX142 | 78P 76 | 383- 388 | 2104-2116 |
| EASTLAND AN[redacted] ITH COUNTIES | CP78TX143 | 78P 77 | 389- 392 | 2117-2166 |
| SAND SHEET [redacted] | CP78TX157 | 78P 86 | 413- 416 | 2284-2318 |
| BELL COUNTY[redacted] | CP78TX179 | 78P 97 | 470- 472 | 2632-2663 |
| HUTCHINSON [redacted] ANDALL COUNTIES | CP78TX197 | 78P104 | 526- 527 | 3050-3063 |
| DUVAL COUNT[redacted] | RP79TX004 | 79P 2 | 4- 5 | 15- 22 |
| BRAZORIA CO[redacted] | RP79TX013 | 79P 5 | 15- 17 | 41- 52 |
| VICTORIA CO[redacted] | CP79TX038 | 79P 13 | 35- 37 | 175- 193 |
| BAILEY COUN[redacted] | RP79TX043 | 79P 17 | 45- 47 | 230- 251 |
| REEVES COUN[redacted] | CP79TX122 | 79P 44 | 140- 143 | 682- 705 |
| HARD-SETTIN[redacted] LS | CP79TX153 | 79P 55 | 186- 187 | 908- 926 |
| REDBED STUD[redacted] | CP79TX154 | 79P 56 | 188- 192 | 927- 969 |
| VICTORIA CO[redacted] | CP79TX191 | 79P 68 | 252- 255 | 1327-1347 |
| FRIO AND ZA[redacted] COUNTIES | CP79TX210 | 79P 80 | 329- 332 | 1714-1739 |
| NSSL SAMPLE[redacted] ARY | CP80TX007 | 80P 1 | 1- 1 | 1- 3 |
| RANDALL COU[redacted] | CP80TX020 | 80P 9 | 38- 39 | 154- 165 |
| ARANSAS, BR[redacted] REFUGIO AND WILLACY C | CP80TX068 | 80P 35 | 111- 114 | 540- 564 |
| ANGELINA CO[redacted] | RP80TX090 | 80P 46 | 148- 150 | 763- 773 |
| WEBB COUNTY[redacted] | CP80TX124 | 80P 54 | 176- 186 | 885- 920 |
| ANGELINA CO[redacted] | CP80TX169 | 80P 65 | 218- 224 | 1147-1215 |
| PERMIAN RED[redacted] TUDY | CP80TX207 | 80P 74 | 276- 281 | 1461-1525 |
| ERATH COUNT[redacted] | RP80TX227 | 80P 84 | 313- 313 | 1618-1619 |
| BUSHLAND RE[redacted] H CENTER, POTTER CO. | CP80TX237 | 80P 91 | 343- 346 | 1782-1813 |
| CROP EVALUA[redacted] RESEARCH SEA-AR | CP81TX005 | 81P 2 | 2- 3 | 6- 21 |
| CAMERON COU[redacted] | CP81TX013 | 81P 5 | 13- 15 | 72- 91 |
| CORYELL AND[redacted] S COUNTIES | CP81TX064 | 81P 24 | 99- 103 | 510- 533 |
| TITUS COUNT[redacted] | CP81TX081 | 81P 32 | 147- 147 | 738- 746 |
| CROP EVALUA[redacted] RESEARCH | CP81TX089 | 81P 38 | 180- 182 | 910- 931 |
| FIELD HYDRO[redacted] COMPARISON CHECK | RP81TX100 | 81P 44 | 189- 187 | 970- 973 |
| FIELD HYDRO[redacted] COMPARISON CHECK | RP81TX105 | 81P 48 | 202- 202 | 1039-1044 |
| VICTORIA CO[redacted] | RP81TX146 | 81P 67 | 298- 298 | 1528-1528 |
| CROP EVALUA[redacted] STUDY | CP81TX158 | 81P 73 | 309- 312 | 1582-1607 |
| CASTRO COUN[redacted] | CP81TX162 | 81P 77 | 326- 326 | 1696-1700 |
| HOWARD COUN[redacted] | CP81TX174 | 81P 84 | 357- 357 | 1676-1682 |
| AUSTIN COUN[redacted] | CP81TX205 | 81P 98 | 446- 447 | 2528-2541 |
| RED BEDS-HI[redacted] AINS STUDY | CP81TX216 | 81P105 | 468- 475 | 2685-2775 |
| GALVESTON C[redacted] | CP81TX240 | 81P117 | 530- 532 | 3131-3153 |
| CROP EVALUA[redacted] RESEARCH | CP81TX259 | 81P131 | 601- 602 | 3563-3578 |
| IRION COUNT[redacted] | RP81TX294 | 81P156 | 779- 783 | 4646-4673 |
| NEUCES AND [redacted] RG COUNTIES-SALINITY | CP81TX305 | 81P164 | 830- 839 | 4951-5046 |
| REDBED STUD[redacted] | CP82TX055 | 82P 28 | 156- 164 | 798- 809 |
| REDBED REFE[redacted] SAMPLES | RP82TX105 | 82P 52 | 293- 300 | 1535-1548 |
| ANDERSON CO[redacted] | RP82TX137 | 82P 67 | 360- 360 | 1855-1858 |
| DELEON SERI[redacted] | RP82TX173 | 82P 85 | 480- 488 | 2424-2426 |
| SMITH COUNT[redacted] IGNITE STUDY | CP82TX178 | 82P 87 | 495- 499 | 2468-2506 |

************** DATA YEAR ****************************** LISTING DATE 06/05/86

| N S S L P R O J E C T NAME | NUMBER | CONSECUTIVE NUMBERS PROJECT | PEDON | SAMPLE |
|---|---|---|---|---|
| HASKELL COUNTY--PERMIAN STUDY | CP82TX205 | 82P104 | 608- 611 | 3146-3191 |
| LEON CO.--LIGNITE STUDY | CP82TX206 | 82P105 | 612- 616 | 3192-3228 |
| LLANO COUNTY IGNEOUS AREA | CP82TX260 | 82P140 | 850- 854 | 4347-4385 |
| JASPER, NEWTON, PANOLA, UPSHUR, GREGG | RP82TX265 | 82P142 | 857- 860 | 4397-4411 |
| JACKSON AND LAVACA COUNTIES | CP82TX269 | 82P144 | 864- 869 | 4420-4473 |
| HARD SETTING PROJECT | RP83TX012 | 83P 10 | 53- 54 | 240- 241 |
| PECOS COUNTY | RP83TX048 | 83P 36 | 210- 210 | 965- 968 |
| ANDERSON COUNTY | RP83TX066 | 83P 50 | 284- 284 | 1269-1269 |
| DELEON SERIES | RP83TX102 | 83P 70 | ,*a- 389 | 1768-1769 |
| MILAM COUNTY | CP83TX163 | 83P 98 | 583- | |
| DENTON AND WISE COUNTIES | RP83TX227 | 83P127 | | |
| GYPSIC SOILS STUDY | CP83TX271 | 83P156 | | |
| SHACKELFORD AND STEPHENS COUNTIES | CP84TX018 | 84P 11 | | |
| LOWER RIO GRANDE VALLEY TEXAS | CP84TX059 | 84P 40 | | |
| PANOLA CO | CP84TX064 | 84P 43 | | |
| BOWIE SERIES | RP84TX065 | 84P 44 | | |
| WINTER GARDEN AREA | RP84TX123 | 84P 89 | | |
| ARCHER CO | RP84TX136 | 84P101 | | |
| KLEBERG CO | CP84TX145 | 84P107 | | |
| WALKER-POLK COS | RP84TX190 | 84P131 | | |
| STEPHENS AND YOUNG COS | CP84TX220 | 84P153 | | |
| JIM WELLS CO | CP85TX034 | 85P 21 | | |
| SHERM SERIES | CP85TX036 | 85P 23 | | |
| BENCHMARK SOILS | CP85TX068 | 85P 41 | | |
| HARLINGEN AREA | RP85TX095 | 85P 60 | | |
| ARCHER CO | RP85TX158 | 85P114 | | |
| TRANS PECOS | CP85TX174 | 85P123 | | |
| HIGH PLAINS | CP85TX283 | 85P186 | | |
| TX-BOWIE STUDY | RP86TX041 | 86P 25 | | |
| KINNEY CO | CP86TX062 | 86P 36 | | |
| YSLETA MISSION | RP86TX083 | 86P 50 | | |
| LLANO CO | CP86TX107 | 86P 60 | | |
| TERRELL CO | CP86TX112 | 86P 62 | | |
| MEDINA CO | CP86TX114 | 86P 63 | | |

Services d'Assistance Technique
en Utilisation des Sols

Servicio de Apoyo para el
Manejo de Suelos

Soil Management Support Services
P.O. Box 2890
Washington, D.C. 20013, USA
Telephone: (202) 475.5330

1. Name of Project:

SOIL MANAGEMENT SUPPORT SERVICES (SMSS)

2. Implementing Agencies:

Soil Conservation Service, USDA
Office of International Cooperation and Development, (OICD), USDA

3. Project Staff:

a. Principal Investigator
Dr. Richard Arnold
Director, Soils Survey Division
Soil Conservation Service, USDA
P. 0. Box 2890, Washington, D.C. 20013
Tel. (202) 382-1819

b. Project Leader
Dr. Hari Eswaran
Soil Management Support Services
P. 0. Box 2890, Washington, D.C. 20013
Tel. (202) 475-5330
Telex, 8423 UHBSP HR

c. Project Monitor
Dr. Ray Meyer
Agency-for-International Development
(S&T/AGR/RNR)
State Department
Washington, D.C. 20523
Tel. (703) 325-8993

d. Full time staff members
- Dr. Hari Eswaran, Washington, D.C.
- Secretary (Position vacant)
- Dr. John Kimble, Lincoln, NE

e. Part time staff members
- Hr. Terry Cook, (50%). SCS
- Mr. William Reybold (10%), SCS

SMSS is a project of the Agency for International Development implemented by the Soil Conservation Service of the U.S. Department of Agriculture

4. Information on the Project:

a. Date commenced: October 1, 1979
b. Date of extension: October 1, 1982
c. Date ends: September 30, 1987
d. Funding (FY1985): $1,250,000.00

5. Project objectives:

a. to provide technical assistance to AID and LDCs in problem identification, evaluation of opportunities and planning and utilization of land resources, especially in the subject areas of soil survey, soil conservation and soil fertility and management;
b. to develop worldwide linkages for the more efficient utilization of agricultural information for crop production;
c. to refine Soil Taxonomy for the Intertropical areas and assist LDC scientists in its use and application in transferring agrotechnology from one region to another similar region.

6. Project activities:

In fulfillment of the first objective, TDYs were provided for:

1. helping countries establish policies and programs for solving problems in land use and food and fiber production;
2. helping plan, carry out, and evaluate soil surveys and soil conservation programs;
3. providing laboratory and field testing services;
4. publishing soil management information that is needed in land-use planning and for food and fiber production;
5. conducting seminars and other training sessions on soil management improvements and soil classification;
6. interpreting soil properties to determine the potentials of the soils for agriculture and to predict their response to management; and
7. dissemination new ideas for increasing soil fertility, improving plant nutrition, and controlling soil erosion and sedimentation.

With respect to the second objective, developing linkages, SMSS has established and worked with more than 30 international organizations and with countless national institutions. Many of the international and regional organizations have supported SMSS sponsored workshops and training courses. Through SMSS initiative and in collaboration with IBSNAT. an ASEAN network and an Oceanic network are being discussed. As a result of the assistance provided by SMSS, many countries are adopting the standards of SCS in their soil survey programs.

Because of the difficulties inherent in the program, SMSS has achieved least towards this objective, Through discussions and lectures, SMSS is encouraging national soil survey organizations to improve the interpretation potential of their soil surveys. SMSS hopes to embark on a soil-crop yield data base.

Probably much of the achievements has centered on the fourth objective. Today more than 40 countries use Soil Taxonomy as the primary system of soil classification and an equal number use it in addition to other systems. SMSS has 8 international committees working to refine Soil Taxonomy.

It has organized five soil classification workshops and thirteen training courses, and produces a number of publications and quarterly newsletter, which recently is published in collaboration with IBSNAT.

- Collaborating institutions:

In the past six years, SMSS has had the privilege to work with the following organizations:

1. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India
2. International Rice Research Institute (IRRI), Philippines
3. International Institute of Tropical Agriculture (IITA), Nigeria
4. Food and Agriculture Organization (FAO), Rome
5. United National Environment Program (UNEP), Kenya
6. International Soil Science Society (ISSS), Nederlands
7. Internation Soil Research and Information Center (ISRIC), Nederlands
8. Office de Recherche Scientific et Technique Outre-Mer (ORSTOM), France
9. Belgian Assistance Development Cooperation (ABOS/AGCD), Belgium
10. German Technical Assistance (GTZ), West Germany
11. Norwegian Technical Assistance (NORAD), Norway
12. Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD), Syria
13. World Bank, USA

14. Centro Agronomico Tropical de Investigation y Ensenanza (CATIE), Costa Rica
15. South East Asian Centre for Research in Agriculture (SEARCA), Philippines
16. Land Resources Division, Ministry of Overseas Development, Great Britain
17. International Benchmark Sites Network for Agrotechnology Transfer, (IBSNAT), Hawaii
18. Australian Centre for International Agriculture Research (ACIAR), Australia
19. International Board for Soil Research and Management (IBSRAM), Thailand
20. Kagera Basin Authority (KBO), Rwanda
21. Food and Fertilizer Technology Centre (FFTC), Taiwan
22. Centro Internacional de la Papa (CIP), Peru
23. Centro Internacional de Agricultura Tropical (CIAT), Colombia
24. International Fertilizer Development Center (IFDC), Alabama
25. Asian Development Bank (ADB), Philippines

** U. S. Universities and LDC national institutions are not included in this list.

9. Training Forums:

a. Forum No.
b. Country
c. Date
d. No. of Participants
e. No. of Countries
f. Collaborating institutions

a.
b. Fiji
c. 1980
d. 2s
e. 8
f. University of S. Pacific, Fiji
Department of Agriculture. Fiji
South Pacific Council, New Caledonia
ORSTOM, France
USAID/Suva

a. II
b. Morocco
c. 1981
d. 45
e. 6

f. Institut National Recherche Agronomique, Morocco
Universiti Hassan II, Morocco
University of Ghent, Belgium
FAO, Rome
ACSAD. Syria
BSP. University of Hawaii/Puerto Rico
USAID/Rabat

a. III
b. Cameroon
c. 1982
d. 30
e. 4
f. Institut National Recherche Agronomique, Cameroon
BSP. University of Hawaii/Puerto Rico
FAO, Cameroon
ORSTOM, France
USAID/Yaounde

a. IV
b. Thailand
c. 1983
d. 65
e. 4
f. Department of Land Development, Thailand
IBSNAT, University of Hawaii/Puerto Rico
FAO, Rome
Rubber Research Institute, Malaysia
USAID/Bangkok

a. V
b. Papua New Guinea
c. 1983
d. 35
e. 8
f. Department of Primary Industries. PNG
IBSNAT
Soil Bureau, DSIR, New Zealand
Soils Division, CSIRO, Australia
University of South Pacific, Fiji
USAID/Suva, American Embassy, PNG

a. VI
b. Costa Rica
c. 1983
d. 30
e. 5
f. CATIE. Costa Rica
CIAT. Columbia
Kellogg Foundation, USA
University of Costa Rica
ROCAP/San Jose

a. VII
b. Philippines
c. 1984
d. 35
e. 3
f. PCARRD, Philippines
Bureau of Soils, Philippines
IRRI, Philippines
USAID/Manila

a. VIII
b. Jordan
c. 1984
d. 25
e. 7
f. Department of Agriculture, Jordan
ACSAD, Syria
University of Jordan
USAID/Amman
Near East Bureau. AID/W

a. IX
b. Guam
c. 1984
d. 30
e. 7
f. University of Guam
University of South Pacific, Fiji
ACIAR, Australia
Commonwealth Foundation, Great Britain
DIS, West Germany
USAID/Suva

a. X
b. Rwanda/Burundi
c. 1985
d. 45
e. 3
f. Carte Pedologic Rwanda
Ministry of Agriculture, Rwanda
Ministry of Agriculture, Burundi
University of Burundi
BADC. Belgium
USAID/Kigali
USAID/Bujumbura

a. IX
b. Zambia
c. 1985
d. 65
e. 6
f. Department of Agriculture. Zambia
University of Zambia
NORAD, Norway
BADC, Belgium
CIDA, Canada
IBSNAT
USAID/Lusaka

a. XII
b. Pakistan
c. 1985
d. 35
e. 1
f. Soil Survey of Pakistan
Pakistan Agricultural Research Council
FAO, Rome
National Fertilizer Development Corporation
Fauji Fertilizer Company
Millat Tractors
IBSNAT
USAID/Islamabad

a. XIII
b. Tunisia
c. 1985
d. 35
e. 11
f. Department of Agriculture. Tunisia
ACSAD, Tunisia
University of Ghent, Belgium
University of Leuven, Belgium
ORSTOM, France
IBSNAT
USAID/Tunisia
Near East Bureau, AID/W

a. XIV
b. Philippines
c. 1986
d. 50 (planned)
e. 6
f. Ministry of Agriculture and Food, Philippines

a. XV
b. Western Samoa
c. 1986
d. 40 (planned)
e. 15 (planned)
f. University of South Pacific, Western Samoa
   University of South Pacific, Fiji
   Soil Bureau, New Zealand
   ACIAR, Australia
   South Pacific Agriculture Research and Development, Western Samoa
   USAID/Suva

10. Workshops, Seminars, Meetings:

a. <u>4th. International Soil Classification Workshop</u>
Rwanda. 2 - 12, June 1981
Theme: Classification and management of Low Activity clay soils and Andisols
sponsors: Institute des Sciences Agronomique, Rwanda
BACD, Belgium
University of Puerto Rico
University of Ghent, Belgium
USAID/Kigali
Participants: 41
countries: 22
Proceedings: Published 1985

b. <u>5th. International Soil Classification Workshop</u>
Sudan. 2 to 11 November, 1982
Theme: Classification and Management of Vertisols
sponsors: Soil Survey Administration, Sudan
Ministry of Agriculture, Sudan
ACSAD, Syria
University of Puerto Rico
USAID/Khartoum
Participants: 40
Countries: 22
Proceedings: Published 1985

c. <u>6th. International Soil Classification Workshop</u>
Chile. and Ecudar. 9 to 20 January 1984
Theme: Classification and management of Andisols
sponsors: University of Puerto Rico
USAID/Quito
American Embassy/Santiago
Sociedad Chilena de la Cienca del Suelo
Universidad Austral de Chile
Universidad de Concepcion
Pontifica Universidad Catolica de Chile
Universidad De Santiago
Sociedad Ecuatoriana de la Ciencia del Suelo
Ministerio de Agriculture y Ganadería, Ecuador
Participants: 39
countries: 17

d. <u>7th. International Soil Classification Workshop</u>
Philippines, 26 March to 5 April 1984
Theme: Characterization. Classification and utilization of Wetlands Soils
Sponsors: IRRI, Philippines
Bureau of Soils, Philippines
USAID/Manila
Participants: 83
Countries: 23
Proceedings: Published 1985

e. <u>8th. International Soil Classification Workshop</u>
Brazil, Hay 9 to 26. 1986
Theme: ICOMLAC/ICOMOX
Sponsors: EMBRADA
University of Puerto Rico
Participants: 100
Countries: 14
Proceedings: 1987

11. <u>Monographs and publications</u>

<u>Technical Monographs</u>

a. Authors et. al.
b. 1981
c. Soil Resource Inventories and Development Planning-Tech. Monograph No. 1
d. USAID, SMSS, SDRASCSS
e.

a.
b.
c.

d.
e.

a.
b.
c.

d.
e.

a.
b.
c.

d.
e.

a. Walter Luzio L.. et. al.
b. 1982
c. Taxonomia De Suelos (Abridged Spanish translation) -Tech. Monograph No. 5
d. Universidad de Chile. Cornell University, Nacional de Tecnologia Agropecuaria, Argentina
e. 200

a. USDA/SCS Soil Survey Staff
b. 1983
c. Keys to Soil Taxonomy-Tech. Monograph No. 6
d. USDA/SCS, SMSS, Cornell University
e. Out of print

a. USDA/SCS Soil Survey Staff
b. 1985 (revised)
c. Keys to Soil Taxonomy-Tech. Monograph No. 6
d. USDA/SCS, SMSS. Cornell University
e. 1500

a. James H. Brown
b. 1984
c. Universal Soil Data Base and Map Display System-Tech. Monograph No. 7
d. Pedologues Incorporated, SMSS
e. 250

a. Frank R. Moormann
b. 1985
c. Excerpts from the Circular Letters of ICOMLAC-Tech. Monograph No. 8
d. ICOMLAC, University of Hawaii, SMSS
e. 300

a. A. Van Wambeke
b. 1985
c. Soil Moisture and Temperature Regimes Asia-Tech. Monograph No. 9
d. Cornell University, SMSS
e. 1,700

Benchmark Soils Of The World

a. T. R. Forbes, et.al.
b. 1985
c. Benchmark Soils of the Yemen Arab Republic - Benchmark Soils of Monograph No. 1
d. Cornell University, SMSS
e. 1,000

a. L. Moncharoen, et.al
b. 1986
c. Benchmark Soils of Thailand
Benchmark Soils Monograph No. 2
d. Department of Land Development - Thailand
e. 1,000

Newsletters

a. Staff
b. October 1981
c. Soil Taxonomy News #1
d.
e. 50

a. Staff
b. January 1982
c. Soil Taxonomy News #2
d.
e. 50

a. Staff
b. June 1982
c. Soil Taxonomy News #3
d.
e. 50

a. Staff
b. September 1982
c. Soil Taxonomy News #4
d.
e. 50

a. Staff
b. February 1983
c. Soil Taxonomy News #5
d.
e. 50

a. Staff
b. August 1983
c. Soil Taxonomy News #6
d.
e. 50

a. Staff
b. January 1984
c. Soil Taxonomy News #7
d.
e. 50

a . Staff
b. August 1984
c. Soil Taxonomy News #8
d.
e. 50

a . Staff
b. November 1984
c. Soil Taxonomy News #9
d.
e. 50

a. Staff
b. April 1985

a. **Staff**
b. October 1985
c. Soil Management Support Services - Training Brochure
d.
e. 300

Progress Reports

a. Staff
b. October 1, 1979 - September 30, 1984
c. Progress Report - SMSS
d. Pedologues Incorporated, SMSS
e. Out of print

a. Staff
b. October 1, 1982 - 1983
c. Progress Report - SMSS
d. University of Hawaii - SMSS
a. 200

Bibliographies

a. Arnold C. **Orvedal**
b. June 1983
c. Bibliography of the Soils of the Tropics
Vol. V. Tropics in General and Tropical
d. **USDA/SCS,** OCID, SMSS. National Agricultural Library
e. 100

International Training Forum Proceedings

a. R. Morrison, D. **M.** Leslie, Editors
b. November 1981
c. Proceedings of the South Pacific Regional
Forum on Soil Taxonomy - No. I
d. University of S. Pacific Fiji, SMSS
e. 5

a. S. Panichappong, L. **Moncharoen,** P. Vijarnson
Editors
b. February 1983
c. Proceedings of the Fourth **Tnternational** Forum
on Soil Taxonomy and Agrotechnology Transfer -
No. IV
d. The Department of Land Development - Thailand. SNSS
e. 200

a. Carlos F. **Burgos, et.al.** Editors
b. 1984
c. **Memoria del Sexto** Foro -
**Taxonomia** De Suelos - No. VI
d. CATIE. SMSS
e. 100

a. A. R. Maglinao, T. M. Metra, M. R. Recel, P. J. Lastimosa, Editors
b. 1985
c. Soil Taxonomy: Tool for Agrotechnology Transfer Proceedings of the VIIth International Forum on Soil Taxonomy and Agrotechnology Transfer - No. VII
d. CARRD, SMSS
e. 200

a. A. Osman, et.al.
b. 1985
c. Proceedings of the VIIIth International Training Forum on Soil Taxonomy and Agrotechnology Transfer - No. VIII
d. ACSAD, SMSS
e. 250

a. J. Demetrio, et.al.
b. 1985
c. Proceedings of the IXth International Training Forum on Soil Taxonomy and Agrotechnology Transfer - No. IX
d. University of Guam, SMSS
e. 400

International Soil Classification Workshops

a. M. N. Camargo, F. H. Beinroth. Editors
b. 1978
c. Proceedings of - First International Soil Classification Workshop
d. EMBRAPA, SMSS. University of Puerto Rico
e. out of Print

a. F. H. Beinroth, S. Paramananthan, Editors
b. 1979
c. Second International Soil Classification Workshop - Part I Malaysia, Part II Thailand
d. National Soil Survey, Malaysia, Soil Survey Division, Thailand, University of Puerto Rico, SMSS
e. Out of print

a. F. H. Beinroth. A. Osman. Editors
b. 1981
c. Proceedings - Third International Soil Classification Workshop
d. ACSAD, Soil Science Institute of Greece, Geologosich Institut, Gent, Belgium, University of Puerto Rico, SMSS
e. out of print

a. F. H. Beinroth, et.al. Editors
b. 1985
c. Proceedings of the Fourth International Soil Classification Workshop
d. Ministry of Agriculture, Rwanda, University of Puerto Rico, SMSS
e. Not Available

a. F. If. Beinroth. M. Ali, H. Osman, et.al. Editors
b. 1985
c. Proceedings of the Vth International Soil Classification Workshop
d. Soil Survey Administration, Sudan, University of Puerto Rico. SMSS
e. Not Available

a. F. H. Beinroth. W. Luzio, L.. F. Maldonado, et.al. Editors
b. 1986
c. Proceedings of the VIth International Soil Classification Workshop
d. Ministry of Agriculture, Chile and Ecuador, University of Chile, Soil Science Society of Chile and Ecuador, University of Puerto Rico, SNSS
e. In press

a.
b. 1985
c. Proceedings of the VIIth International Soil Classification Workshop
d. IRRI. Bureau of Soils, SMSS
e. 200

Audio Visual Aids

a. Staff
b. August 1982
c. Soil Taxonomy: A Technical Language of Soil Science (a slide and cassette tape, a 16mm film, a 8mm film)
d. Cornell University, SMSS
e. Limited quantities

a. Staff
b. May 1986
c. Training Forums - video tape
d. Cornell Univeristy, SMSS
e. In draft copy

Computer Software Programs

a. S. W. Buol, R. A. Rebertus
b. 1985
c. Soil Taxonomy Keys to Classification Computer Software Programs No. 1 Interactive Program to Classify Soils Using Soil Taxonomy
d. North Carolina State University, SMSS
e. 250

12. Linkages (Fig. 1)

a. USAID Projects

SMSS collaborates with IBSNAT and TSKM. WIth IBSNAT. it has a joint newsletter (Agrotechnology Transfer);. SMSS also characterizes some of IBSNAT experimental sites and IBSNAT provides management Information for SMSS World Benchmark Soils Database. SMSS and IBSNAT cost-share some of the training activities and some meetings.

SMSS and TSMM has cost-shared a workshop and some TDYs.

b. International Agricultural Research Center

SMSS has good working relations with ICRISAT, IITA and IRRI. Have organized joined workshops.

c. USAID Country Missions

Missions have always supported SMSS activities. A few like USAID/Bangkok, USAID/Suva, USAID/Lusaka, USAID/Amman and USAID/Islamabad have even funded SMSS activities. Near East Bureau of AID/W provides annually $50.000 to organize training courses.

13. (a) Major Achievements

- Excellent rapport with LDC institutions and USAID Missions.
- Many countries (fig. 2) use Soil Taxonomy and soil survey procedures of SCS-USDA.
- Publications are used and referred to in technical discourses and some are translated.

Training courses largely funded by others; well attended and good feed-back.

- Workshops, cost-shared and participated by world-reowned soil scientists.
- SMSS honoured by several organizations including the Governor of Guam.

(b) Major constraints

- SCS-USDA staff-ceiling prevent hiring of new staff.
- Project has poor secretarial support and for the moment, none.
- OCID's contractual procedures cumbersome and In some instances restricts utilization of talented or experienced persons.
- USAID Bureaus and many USAID Country Missions are not well informed of S&T's centrally funded projects.

14. Utilization and impact

Because SMSS is a world-wide program, it cannot have the kind of impact as a country-specific project. Nevertheless. there is some evidence of the project outputs being utilized.

This does not include the salaries and other services of the many persons who contributed to the activities.

The training workshop components are also bearing fruit, with countries developing their own In-service training programs using SMSS training packages. ACSAD is an example of a regional institution which as obtained $175,000 from the Arab League. to conduct its own training in Arabic on Soil Taxonomy. SHSS Monograph No. 6 -- Keys to Soil Taxonomy -- is now translated into Spanish, French, Japanese. Chinese. Italian, Malay, Thai and the Greek translation is being worked on.

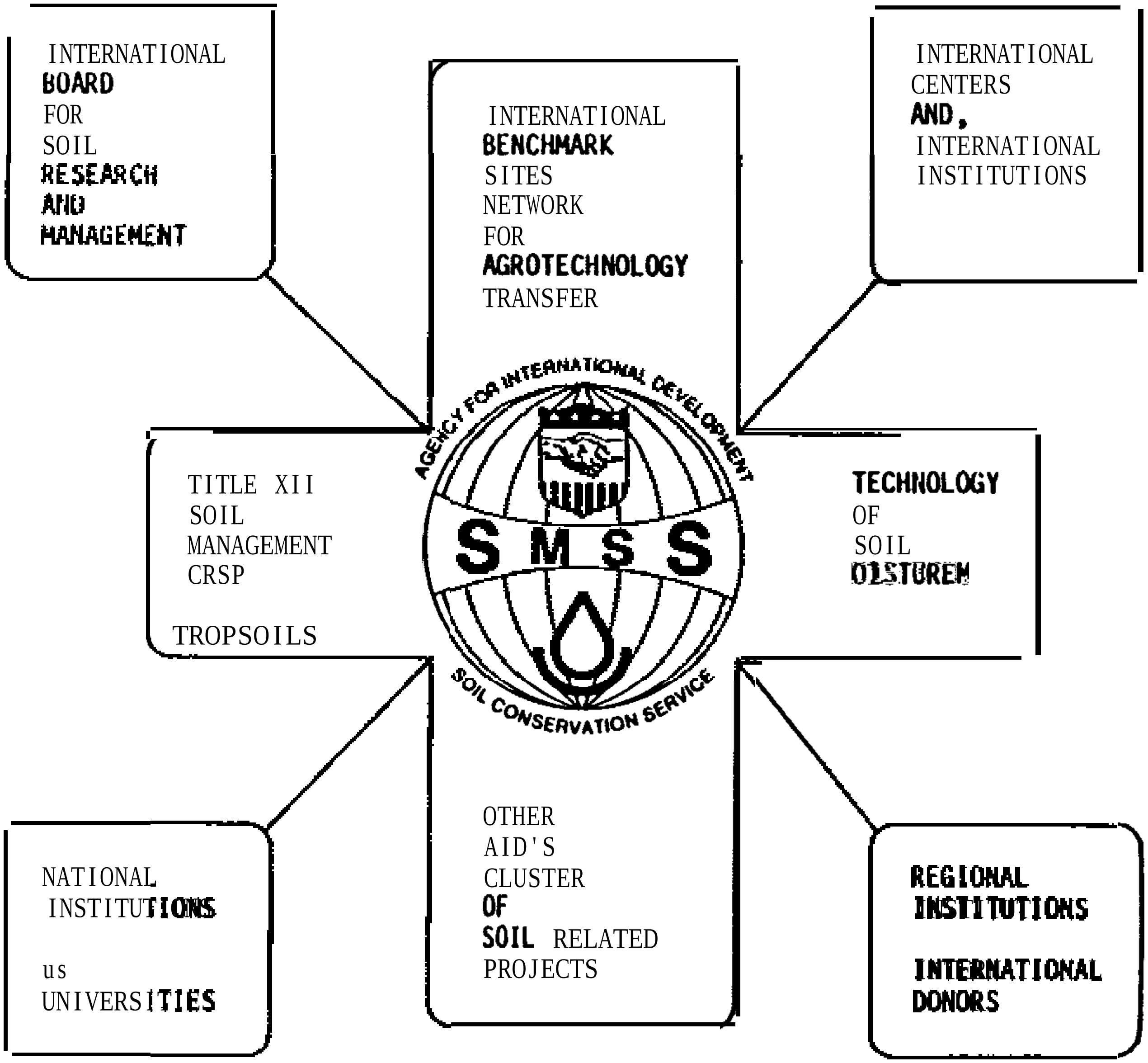
SMSS continues to service USAID Bureaus and Missions and the technical assistance component is maintaining its momentum.

I" conclusion, there is ample evidence to Indicate that SMSS activities are useful, necessary, appreciated and followed up.

[illegible]

| COUNTRY | FY 80 TDY | FY 80 P/D | FY 81 TDY | FY 81 P/D | FY 82 TDY | FY 82 P/D | FY 83 TDY | FY 83 P/D | FY 84 TDY | FY 84 P/D | FY 85 TDY | FY 85 P/D | TOTAL TDY | TOTAL P/D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belize | | | 1 | 5 | | | | | | | | | 1 | 5 |
| Bolivia | | | 1 | 17 | | | | | | | | | 1 | 17 |
| Botswana | | | | | | | | | | | 1 | 7 | 1 | 7 |
| Brazil | | | | | | | | | 2 | 12 | 1 | 35 | 3 | 47 |
| Burundi | 1 | 4 | | | | | 3 | 16 | 2 | 12 | 2 | 18 | 8 | 50 |
| Cameroon | 1 | 3 | | | | | | | | | | | 1 | 7 |
| Chile | | | | | | 10 | 2 | 23 | | | | | 4 | 33 |
| Costa Rica | | | | | 3 | 33 | 4 | 50 | 2 | 14 | | | 9 | 97 |
| Djibouti | | | | | 3 | 63 | 2 | 43 | 1 | 46 | | | 6 | 152 |
| Ecuador | | | 4 | 83 | 4 | 47 | 2 | 19 | | | | | 10 | 149 |
| El Salvador | | 8 | | | | | 1 | 2 | | | | | 3 | 10 |
| Fiji | | | | | | | 1 | 28 | | | | | 1 | 28 |
| Guam | | | | | | | 1 | 10 | 1 | 4 | | | 2 | 14 |
| Guatemala | | 14 | | | 1 | 3 | 1 | 7 | | | | | 4 | 24 |
| Honduras | | | | | 1 | 6 | 1 | 4 | | | | | 2 | 10 |
| India | | | 1 | 45 | 1 | 35 | 5 | 40 | 2 | 6 | 1 | 8 | 10 | 134 |
| Indonesia | | | 2 | 20 | 3 | 45 | | | 2 | 26 | 6 | 84 | 13 | 175 |
| Jamaica | 2 | 28 | | | | | | | 1 | 13 | 2 | 24 | 5 | 65 |
| Jordan | | | | | 1 | 24 | | | 3 | 20 | | | 4 | 44 |
| Kenya | | | | | | | | | 1 | 2 | | | 1 | 2 |
| Lesotho | | | | | | | 1 | 20 | 1 | 4 | | | 2 | 24 |
| Liberia | | | 1 | 15 | | | | | | | | | 1 | 15 |
| Malaysia | | | | | 1 | 5 | | | 1 | 4 | | | 2 | 9 |
| Mali | | | 1 | 1 | 1 | 25 | | | | | | | 2 | 26 |
| Morocco | | | | | | | 1 | 7 | | | | | 1 | 7 |
| Nicaragua | | | | | 1 | 12 | | | | | | | 1 | 12 |
| Nigeria | | | | | | | | | 1 | 4 | | | 1 | 4 |
| Pakistan | | | | | | | | | 3 | 58 | 2 | 7 | 5 | 65 |
| Panama | | | | | 1 | 30 | 3 | 17 | | | | | 4 | 47 |
| Papua New Guinea | | | | | 2 | | | | | | | | 2 | 37 |
| Peru | | | | | | | | | | | | | 6 | 118 |
| Philippines | | | | | 1 | 5 | 3 | 62 | 1 | 4 | | | 10 | 145 |
| Puerto Rico | | | | | 1 | 7 | | | | | | | 2 | 14 |
| Rwanda | | | | 35 | 1 | 30 | 3 | 18 | 2 | 14 | | | 13 | 129 |
| Senegal | | | 3 | 63 | 1 | 11 | | | 1 | 11 | | | 9 | 149 |
| Somalia | | | | | | | 1 | 29 | 2 | 16 | | | 3 | 65 |
| South Korea | | | | | | | | | | | | | 1 | 4 |
| Sudan | | | 4 | 59 | | 10 | | | | | | | 5 | 69 |
| Suriname | | | 1 | 5 | | | | | | | | | 1 | 5 |
| Swaziland | 1 | 1 | | | | | | | | | | | 1 | 1 |
| Syria | | | 3 | 35 | | 27 | | | | | | | 4 | 62 |
| Tanzania | | | 1 | 7 | | | | | | | | | 1 | 7 |
| Thailand | | | 1 | 40 | | 73 | | 94 | | 29 | | 20 | 15 | 284 |
| Trinidad | | | 1 | 7 | | | | | | | | | 1 | 7 |
| Tunisia | | | | | | | | | | | | | 3 | 22 |
| Venezuela | | | 1 | 7 | | | | | | | | | 1 | 7 |
| Western Samoa | | | | | | | | | | | | 26 | 2 | 26 |
| Zambia | | | | | | | 1 | 4 | 1 | 31 | | | 6 | 77 |
| TOTAL | 19 | 279 | 31 | 452 | | 538 | 40 | 493 | 32 | 350 | 37 | 394 | 193 | 2503 |

** Year country was first visited is underlined


INTERNATIONAL BOARD FOR SOIL RESEARCH AND MANAGEMENT
INTERNATIONAL BENCHMARK SITES NETWORK FOR AGROTECHNOLOGY TRANSFER
INTERNATIONAL CENTERS AND, INTERNATIONAL INSTITUTIONS
TITLE XII SOIL MANAGEMENT CRSP
TROPSOILS
AGENCY FOR INTERNATIONAL DEVELOPMENT
SMSS
SOIL CONSERVATION SERVICE
TECHNOLOGY OF SOIL
NATIONAL INSTITUTIONS
US UNIVERSITIES
OTHER AID'S CLUSTER OF SOIL RELATED PROJECTS
REGIONAL INSTITUTIONS
INTERNATIONAL DONORS

CEOFII

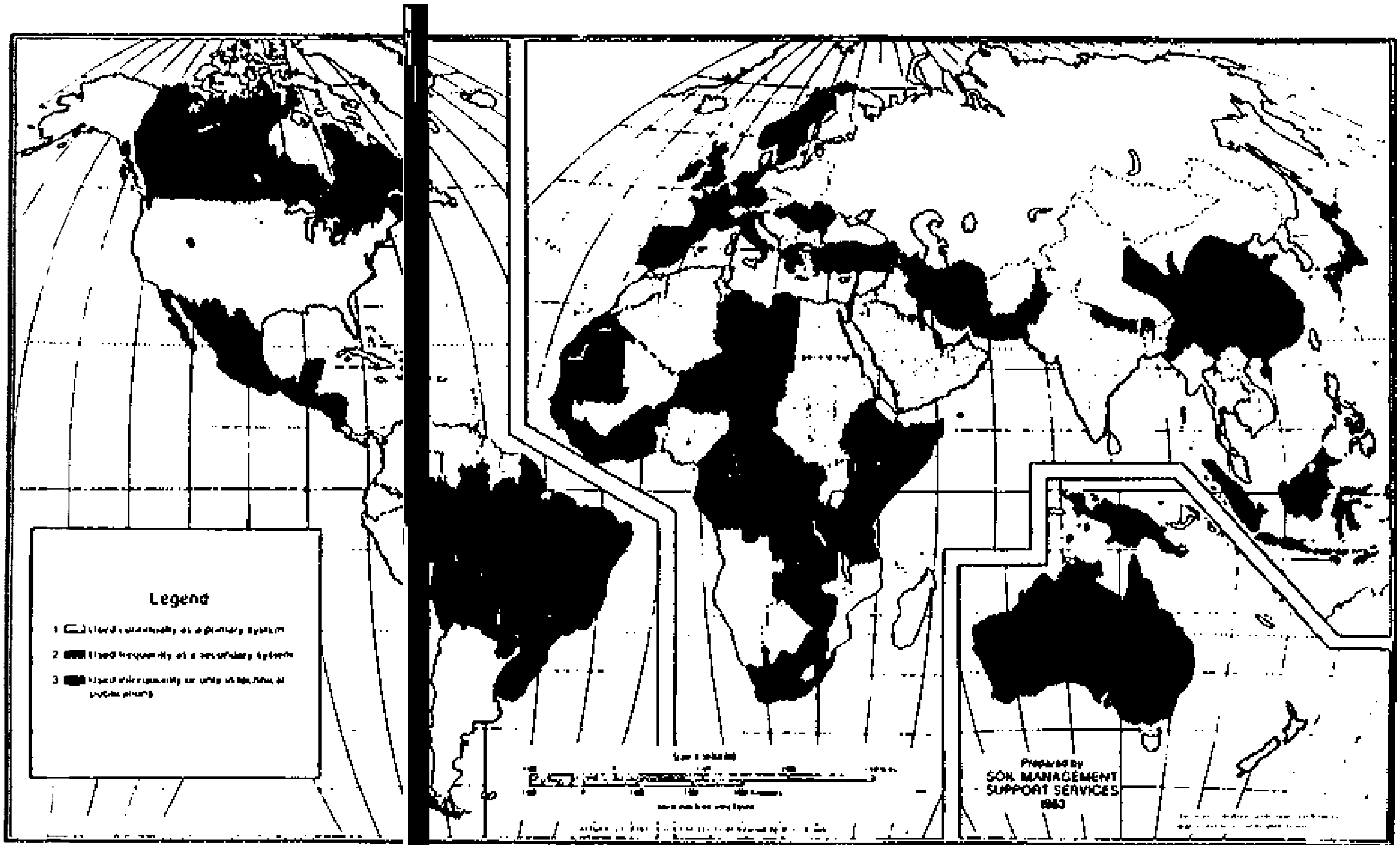



Figure 2. International use of *Soil Taxonomy* (1984).

SOIL SURVEY INVESTIGATIONS
ELLIS G. KNOX
SOIL CONSERVATION SERVICE
WASHINGTON, DC
JUNE 1986

As an oldtimer in the National Cooperative Soil Survey, I am happy to meet with you in your regional conference. As a newcomer to the Soil Conservation Service. I have come to listen, learn. and get acquainted.

At present there are four of us in soil survey investigations on the National Headquarters staff.

I have general technical responsibility for soil survey investigations throughout the SCS.

Milt Meyer, who was acting national coordinator, continues to look after radiation safety, coordinate the national soil moisture study (in which neutron probe measurements have been made in Texas, Georgia, Indiana, North Dakota, Washington, Colorado, and Iowa), and work with EPA on its acid deposition studies and with ARS on the lead-cadmium study.

Ron Paetzold has completed his work in cooperation with ARS to develop a nuclear magnetic resonance device for measurement of surface soil moisture and, since January, has been making an overall study of soil climate (water and temperature) with respect to soil taxonomy, soil interpretations, and standardization of methods.

Oliver Rice moved about 1 June to Temple, Texas, to take Wes Fuchs' place with ARS and ERS modelers to provide soil survey input to the EPIC and other erosion-productivity models and to extract as much information useful to the soil survey as possible.

There are modest hopes for a soil-geomorphology position with a first assignment in the Palouse region of the Pacific Northwest.

In addition, the overall SCS soil investigations program includes the National Soil Survey Laboratory, as its main effort, and the work of Reese Berdanier in the South and Erling Gamble in the Midwest and Northeast in NTC research positions. We should not overlook the research that is and can be done by SCS state and field office soil scientists. I am looking for ways to encourage, support (probably not with funds), improve, and extend these local studies and their results.

We all know that the agricultural experiment stations (AES) at state universities are a major part of the NCSS research effort. I want to do all I can to:

- learn what research is going on.
- arrange appropriate assistance whenever possible.
- serve as a link or catalyst when that is helpful.
- suggest research topics based on needs of the soil survey.
- encourage SCS soil scientists to undertake graduate study.
- encourage SCS state offices to facilitate graduate study.

We should also recognize that the Forest Service and other participants in the NCSS contribute to soil survey investigations.

I'll mention just a few of my current concerns:

1. There is a major effort to make the data of the SCS laboratories widely available. This involves merging three data bases of analytical results and adding pedon descriptions. When we have some confidence that we can handle our own data we will be very pleased to work with the AES laboratories to develop integrated data bases at national, regional, and state levels. In the meantime, we welcome and applaud the AES work that is already going on and will be as responsive as we can.

2. The National Soils Handbook emphasizes the role of benchmark series to focus investigative efforts. In practice, we ignore them so thoroughly that I am about to conclude that the benchmark soil idea is not useful. Some other way to organize and make best use of our investigations may be needed. Concentration of efforts in a few selected soil survey areas may give us a level of understanding. about how the soils relate to the landscape, function in the natural environment, and perform under use and management, that can be extended to other soil survey areas.

3. Ground penetrating radar offers us a new view of the soil. It probably will not be as revolutionary for soil survey as aerial photographs, but the possibilities for its use in mapping, research, special investigations, selection of laboratory sampling sites, description of mapping units, etc. are exciting. We need to be working out how, where, how often, and by whom it will be used.

4. Probably all of you have your own ideas about research needs.

I invite you to suggest what research is needed in and for the NCSS, how it should be done, who should do it, and what cooperative arrangements would be helpful. I want to do all I can to facilitate soil survey research to meet these needs.

# No-Till Farming: An Overview of Its Effect on Pedogenesis

K.L. Wells, Department of Agronomy
University of Kentucky

No-till systems of crop production are now widely used in many sections of the USA and in other parts of the world. In contrast to conventional preparation of seedbeds, the only mechanical soil disturbanced in no-till systems is in a narrow band of 1-2 inches width made only for the purpose of inserting seeds below the soil surface. In a continuous no-till system, then, there is no mechanical incorporation of plant residues, lime, or fertilizer into the Ap soil horizon. Reports from long-term studies of continuous no-till production of corn when compared with conventional production systems, have shown the following changes in degree and intensity of physical and chemical processes in the rooting zone of soils due to no-till.

Temperature - soil temperature remains cooler in the spring and summer and probably warmer In late fall and early winter,

Moisture Content - soil moisture content is higher between events of moisture re-charging due to reduced surface evaporation.

Organic Matter - total organic carbon content increases. Organic matter stratifies at the surface since it is not mechanically incorporated.

Acidity - a thin layer of strong acidity develops at the top of the mineral soil immediately underlying the layer of plant residues which accumulate at the surface.

Total Nitrogen - total N content increases with most of the increase occurring in the top 3 surface inches.

Microbial Activity - there is greater activity of microbes at the surface of the mineral soil resulting in increased populations of both aerobic and anaerobic bacteria.

Surface - erosion rates of surface soil are reduced to practical insignificance.

Although there is not a wealth of research to support the concept, many no-till researchers feel that soil structure is improved and that there is development of more continuous large pores which results In faster and deeper infiltration of water into no-tilled soils.

My viewpoint of the long-term effect of no-tlllage on pedogenesis is that continuous use of the practice shifts vegetation and time into more influential roles in on-going pedogenesis than they have played since intensive mechanical cultivation of soils was initiated. As a result, my speculation is that profile characteristics of cultivated soils which have been shifted to no-tillage will slowly revert to the horizonation (kinds and characteristics) which would be expected In undisturbed soils of specific climatic zones.

The rate at which such changes will take place is not currently known. However, as shown by the surface profile which was displayed, a morphologically discernible horizonation of darker colored (assumedly from soluble organic residues) mineral soil had developed on a low terrace soil in eastern Kentucky after only 5 years of continuous no-till production of corn.

## Site Index Curves

Constance A. Harrington [1]

Site index is the most commonly used measure of site quality for forest land. It is defined as the mean height at a specified index age of upper crow" class trees of seed origin that have been free-to-grow for their entire life. The index age varies somewhat by species, region of the country, and intensity of management. I" the South, the most common index age is 50 years for natural stands and 25 years for plantations. [2] Site index can only be directly measured when stands withsuitable measurement trees are at index age. Site index can be estimated for stands which are younger or older than index age by using published site index curves or equations. Site index curves provide a graphical method of estimating site index from height and age information. Assuming the sample trees meet the qualifications of the definition (i.e., upper crow" class, free-to-grow, seed origin) and have been measured correctly, the main factor influencing the accuracy of the estimation will be how closely the site index curve follows the patter" of height development in the sample stand.

Site index curves can be inaccurate because of: (1) sampling bias, (2) mathematical restrictions on curve shape, (3) site-specific factors, (4) silvioultural treatment, (5) population (genetic) differences, and (6) climatic or temporal effects. Beck and Trousdell (1973) present an excellent discussion on this topic. Sampling bias results when curves are developed using temporary plots and there is an uneven distribution of site quality classes across age categories; this problem can be especially serious when the percentage of sampled trees having ages close to index age is low. Mathematical restrictions on curve shape influence both the form or shape of a particular curve and whether or not all the curves in a set of site index curves have the same (proportional) shapes. Polymorphic curves (having different shapes by site index class) are favored for both biological and mathematical reasons; however, the simpler anamorphic curves require less data for curve fitting.

Site-specific factors, such as soil drainage class, depth to fragipan, or soil nutrient status, may influence height growth development patterns, thus, requiring separate curves for different soil-site conditions. In addition, silvicultural treatments--during stand establishment or later in the stand's life--and differences between genotypes csn influence both curve shape and curve height.

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[1] Research Forester, Southern Forest Experiment Station, P. 0. Box 3516, Monticello, AR 71655

[2] A list of published site index curves for loblolly pine, shortleaf pine, slash pine and longleaf pine is available from the author.

Finally, if a factor which influences site quality varies over time, such as major drought cycles, warming trends, or atmospheric chemicals, then the pattern of height growth may be quite different from that which was sampled when the site index curve was developed.

Construction of new site index curves by soil series, groups of soil series, or soil drainage class has been suggested by many soil science and forestry researchers and practitioners. Differences in curve shapes have been demonstrated to occur, particularly between very poorly or poorly drained soils and the other drainage classes. Because of the increasing emphasis forest managers are placing on obtaining accurate growth and yield information on a site-specific basis, I believe development of new site index curves tied to soil properties is a worthwhile project. If new site index curves based on soil properties are to be a substantial improvement over existing curves, however. attention must also be given to the other factors which influence the accuracy of site index determination.

## Literature Cited

Beck, Donald E. and Kenneth B. Trousdell. 1973. Site index: Accuracy of prediction. USDA Research Paper SE-108. Southern Forest Experiment station, Asheville, N.C.

June 1986

# Parting Remarks

Dick Arnold

Friday, June 13, 1986

Lexington, Kentucky, SNTC RSSC

And now a message you can't resist - some views of this conference with a twist...

1. The conservation reserve provisions of the 85 Farm Bill are concerned with lands that erode at rates greater than 2T and which may be degrading their sustainable productivity. Removing these lands from cropping by long term contracts is a consideration.

2. Throughout the country their are lands being cropped that differ in the sensitivity to erosion. In the southern region there are many soils which if cropped in the same old ways would be subject to high rates of erosion. Many of these areas are subject to high rates of erosion. Many of these areas are subject to the sodbuster provisions of the Farm Bill.

3. The NCSS is interested in assisting by providing soil maps and reports for these lands. Not only must we continue to provide our services. in many places we are being asked to accelerate--primarily to accelerate the mapping. Also we must work hard to keep up the supporting documentation.

4. If sod is busted in the wrong places, the land is irreparably altered for the purposes that people had intended.

5. If swamps are busted the consequences are often far more reaching than initially expected. In the view point of some, swamp busting needs the same careful consideration as sodbusting.

6. We. in the NCSS, are well known for our understanding. or at least recognition, of soil variability, We train ourselves and others to map systematic variability and work diligently to describe and explain the randomness of soil properties that occur. Thus the maps and the reports both carry Important information about soil variability.

7. Even an unpractical eye can detect differences in this field-observable in surface color and plant response.

8. Soil maps delineate the obvious and even sometimes the less obvious differences. For the various map units interpretations are presented for potential users.

9. More and more we are measuring and mentioning the probability and reliability of our statements about soil map units. We are learning how to obtain such estimates but so far have much less experience in presenting such Information to users. A consumer's risk is related to the accuracy expressed by the lower confidence limit. It is obvious that we have a long way to go to assist people with these aspects of soil interpretations.

10. When we write about yields, in this case. crop yields under a high level of management, do we suggest that these yields can be expected only for a given percent of the area within delineations of the map unit? Or do we tend

to imply that every place within the named delineation will respond similarly? Well, I leave that judgment to you and to the readers of our reports.

16. Technology transfer draws heavily on research findings at the experiment stations. Management practices, varieties, fertilizer, and explanations are important results of this research.

17. Improved moisture values have been derived from theory and empirical relationships. Changes of moisture patterns related to drainage and crop use are closer to observed field changes.

18. Soil data, climate data. crop data, and many of the interactions are being simulated with computer models. CREAMS Z, EPIC, ALMANAC. CERES, and other models feed on tremendous amounts of data.

19. The models simulate soil moisture, its locations, and impact on nutrient use and plant growth.

20. Rooting depths and limiting layers are incorporated in many of the simulation models. Soil properties of specific sites or generalized profiles can be used.

21. Simulation models like EPIC consider management practices like conservation tillage and various crop rotations. These models provide information that allow scientists to evaluate alternatives of crops, of management, and of oils and climatic conditions.

22. Estimating crop yields is a major objective of the simulation models. Insofar as the results are reasonable, extrapolations to other sites and

23. Our future interpretations will need the best soils information we can provide. Other scientists will rely on our ability to assist them in understanding soil properties and interactions as we know them.

24. Improved pastures are also important interpretations. They are not always easy and require care and attention.

25. And this week we have discussed forest management and site indices. Somehow one gets the impression that this tree was not “free-to-grow” and thus not a good representative for a site measurement. On the other hand it’s story might be a fascinating one indeed.

26. Crop phenology is just as important in estimating tree growth and behavior as It is for other crops.

27. As we move ahead in the NCSS we remain committed to two major objectives: (1) providing the best soil maps we can as we complete a once-over mapping of the U.S. and (2) helping people to understand soils and to wisely use these resources through the Basic Soil Services outreach activities.

28. Thank you for being the best--for caring and for sharing--for being the “good hands” of the U.S. soil survey.

Business Meeting - Glenn Kelley Presiding

Darwin Newton invited the conference participants to meet in Tennessee for the 1988 meeting.

The group voted to accept Darwin's proposal.

Joe Nichols pointed out that after accepting the offer to go to Tennessee in 1988. that the group had met in every location except Puerto Rico.

After considerable discussion the group voted an intent to meet in Puerto Rico in 1990. A report will be given at the 1988 meeting on transportation and room costs and on Puerto Rico's willingness to host the conference. We will make a final decision at that time.

The group voted a commendation to Dr. A.D. Karathanasis and Glenn Kelley for exceptional work in hosting the 1986 meeting.

Locations for biannual meetings of the Southern Regional Work Planning Conference of the Cooperative Soil Survey.

| YEAR | LOCATION |
|---|---|
| 1986 | Lexington, KY |
| 1984 | El Paso, TX |
| 1982 | Orlando, FL |
| 1980 | Oklahoma City, OK |
| 1978 | Jeckyl Island, GA |
| 1976 | Jackson, MS |
| 1974 | Mobile. AL |
| 1972 | Blacksburg, VA |
| 1970 | Baton Rouge, LA |
| 1968 | Clemson. SC |
| 1966 | Lexington, KY |
| 1964 | College Station, TX |
| 1962 | St. College, MS |
| 1960 | Stillwater, OK |
| 1957 | Fayetteville, AR |
| 1956 | Raleigh, NC |
| 1955 | Knoxville, TN |

## SOUTHERN REGIONAL INFORMATION EXCHANGE GROUP 22

### Minutes of Meeting

### June 12, 1986
### Lexington, Kentucky

The meeting was calledtoorderat 12:45 P.M. by H. F. Perkins and B. R. Smith was asked to record theminutes.

S. W. Buoldiscussedthehistoryof thedevelopmentof thekandic horizonand the kandigreat groups. He traced the development of the criteria used to separate the Paleudults and the Hapludults, elaborated on the problems of identification of argillic horizons, and presented information on revisions of Soil Taxonomy.

L.P. Wildingdiscussedshrink-swell in soils. He noted the many factors that are involvedinvolume changes of soils upon wetting and drying. Heemphasized that pore or interparticle water is much more important in shrink-swell in most soils than is interlayer water, and encouraged the teaching of this concept in soils -es.

B. R. Smith briefly discussed the financial status of "Soil Survey Horizons" and notedthatit is now in the black. lie stressed the need for additional subscribers to the publication.

W. H. Hudnallmentionedthepossibilityof cooperative research with a Frenchvomanonpaleoclimateand redsoils. Hequestioned why many of the red soils in the region are so similar in morphology and chemicalandphysicalproperties to red soils in France, Germany, and Italy. He stated that the names of several individuals in the Southern Region who might be possible cooperators had been given to her.

L. P. Wilding encouraged D. M. Gossett to reemphasize to the administration of the various state cooperators the importance of the soil survey work-planning conferences. He noted that some states were not well represented at this conference.

After considerable discussion, L. P. Wilding presented three motions; (i) that the Soil Survey Investigations Report No. 1 (SSIR No. 1) be adopted as the methods manual used in the Southern Region for soil characterization for cooperative soil surveys; (ii) that efforts be made by R.W. Arnold and J. E. Witty to get SSSR No.1adopted as the methods manual used in the other regions for soil characterization for cooperative soil surveys at the work-planning conferences thisyearof the Northeast, North Central, and West regions; and (iii) that the National Soil Survey Laboratory lead efforts to get the methods and procedures of SSIR No. 1 adopted as American Society of Testing Materials (ASTM) standards. The motions were seconded and approved.

A. D. Karathanasis (term 1986-1989) and M. E. Collins (term 1987-1990) were elected as Southern Regional representatives to the committee on admendments to Soil Taxonomy.

W. H. Hudnall was elected as chairman and E. M. Rutlege was elected as secretary of the group for 1986-1988. Their terms will expire at the end of the conference to be held in 1988.

The meeting adjourned at 3:00 P.M.

Submitted by,

B. R. Smith

Participants:

R. W. Arnold, USDA-SCS
H. H. Bailey, University of Kentucky
S. W. Buol, North Carolina State University
V. W. Carlisle, University of Florida
D. M. Gossett, University of Tennessee - Knoxville
W. H. Hudnall, Louisiana State University
A. D. Karathanasis, University of Kentucky
E. G. Knox, USDA-SCS
W. G. Lynn, USDA-SCS

# AGENDA

## Southern Regional Soil Survey Work Group

REPORT OF THE SOUTHERN REGIONAL SOIL TAXONOMY COMMITTEE
June 1, 1986

1. Action Taken

May 15, 1986 - received from John Witty - question on classification about use of lime to reflect soil moisture regimes. I sent John another copy of a proposal to make this change from several years ago. We need more work on soil moisture regimes.

March 12, 1986 - sent to Southern Regional Taxonomy Committee. Proposed to add to Fraglossudalfs, the definition, the distinction between Typic Fraglossudalfs and other subgroups and the description of the subgroups. Answers due to me by May 2. A few questions to answer before submitting.

November 19, 1985 - comments to R. Arnold answering an inquiry on a proposal from the 1970's to amend Ultic Paleustalfs by changing the distinction. We had recommended this change earlier. It was in the 1978 list of changes that were recalled, but we did not revert to the earlier definition. We recommended again that the earlier change be made.

October 8, 1985 - comments to R. Arnold from the Southern Regional Taxonomy Committee proposing an amendment in the definition of the calcic horizon and petrocalcic horizon. We were notified that the proposal was not recommended by any of the other regional committees. There was a suggestion that we could submit the proposal to ICOMID if we desired. I am proposing an Aridisol soil correlation tour with the West region. We hope to make the trip an international function.

November 18, 1985 - comments to R. Arnold from Southern Regional Taxonomy Committee proposing that the implied subgroup Ustic Quartzipsamments be added to Soil Taxonomy.

August 26, 1985 - comments to Arnold on why the term 5 YR or yellower is in the distinction between Typic Paleudalfs and other subgroups. Answer from R. Fenwick that no reason was found and that it would be removed.

June 5, 1985 - comments to R. Arnold from Southern Regional Taxonomy Committee on proposed changes in Haplaquods. The comments were on changes recommended Jan. 25, 1983 by the S.R. Taxonomy Committee. These changes were made on amendment Issue No.7, October 15, 1985.

June 5, 1985 - comments to R. Arnold With a recommendation to approve our Jan. 25, 1983 recommendation on Fragic and Fragiaquic Paleudults. These changes were approved on the amendments Issue No.7, 1985.

March 20, 1985 - comments to Richard Fenwick on an earlier recommendation to key siliceous mineralogy to Quartzipsamments. These were approved on amendment Issue No.7, 1985.

11. Committee Members

| Term Expires at the Work Planning Conf. or in May of Interim years | State Representatives | Federal Representatives |
|---|---|---|
| 1985 | Dr. B.L. Allen | Donald Hallbick |
| 1986 | Dr. David Lietzke | Darwin Newton |
| 1987 | Dr. Wayne Hudnall | Wade Hurt |
| 1988 (Term began in 1985) | Dr. Bill Smith | Larry Ward |

Elected at the 1986 Southern Regional Technical Work Planning Conference

| Term Expires at the Work Planning Conf. or in June of Alternate years | State Representatives | Federal Representatives |
|---|---|---|
| 1989 | Dr. A.D. Karathanasis | John Robbins |
| 1990(Terms begin in 1987) | Dr. Mary E. Collins | B. Arville Touchet |

NCSSC
Lexington, KY
June 10-20, 1986
J.E. Witty

# SOIL TAXONOMY AND THE INTERNATIONAL SOIL CLASSIFICATION COMMITTEES

The purpose of this report is to review the activities of the International Soil Classification Committees and to encourage active participation in these committees. I am also leaving plenty of time for questions to make sure that I cover as much as possible the topics in which you are most interested.

The committees were organized to help coordinate the improvement of Soil Taxonomy and to make it a comprehensive system. The committees have an open membership and the chairmen of the respective committees correspond with the membership by "Circular Letters."

I believe it is fair today that most of the committees have concentrated on trying to make soil taxonomy more useful in areas where little soils data was available at the time it was published. Soil Taxonomy is considered a de facto international soil classification system, and I think this is due to the work of the committees.

I believe we all benefit from maintaining soil taxonomy as a comprehensive system. If we had looked only inward, in other words, if we had only considered the soils of the U.S. when developing and maintaining soil taxonomy, the committees would not have been needed. I like Guy Smith's thoughts on why we should look "outward" for help with Soil Taxonomy. He writes: "A comprehensive system should let us see the soils of the United States in better perspective." He continues, "If one develops a classification of the soils of a single country, he will only by accident develop a classification that will be useful in other countries...A classification developed for a country becomes warped by the accidents of geology, climate, and the evolution of life in that country, and is apt to reflect soil genesis in a manner that appears distorted to one familiar with the soils of a different country..." In his opinion a comprehensive system should also aid in the transfer to this country of experience gained in other countries.

There are 8 International

7.
8.

<u>The International Committee on Low Activity Clay</u> completed its mandate about two years ago. Since that time the proposal was sent out by the Soil Conservation Service for testing. Last winter the comments were evaluated and incorporated into the final amendment. Through the spring incorporated into the final amendment. Through the spring it has gone through additional testing, with a few changes made. The amendment is essentially ready to be released, but Frank Moormann made a special request to look at it one more time before we release it. We are waiting for his final comments.

The major changes resulting from this amendment are:

1. The introduction of a new diagnostic horizon, the kandic horizon, which is identified on the basis of (a) havin a clay increase similar to that defined for an argillic horizon, and (b3 having a CEC of 16 meq/100 g of clay (In some cases the kandic horizon will also be recognized-as an argillic horizon), and

2. The introduction of "kandi" and "kanhapl" great groups of Alfisols and Ultisols. These great groups parallel the "pale" and "hapl" great groups, respectively, concerning clay distribution with depth.

In the United States the approval of this amendment will have the greatest impact on classification of the soils in the Southeast. A few soils in California and Hawaii will also require reclassification. It is difficult to evaluate the true benefits of reclassifying our soils on the basis of this amendment, but surely it will facilitate the transfer of information about the management of these soils from other parts of the world. It will also emphasize the main limitations of these soils.

<u>The International Committee on Oxisols</u> is putting the final touches on the ICOMOX proposal before submitting it to the Soil Conservation Service to send out for final testing. The ICOMOX committee has been active for about 8 years, and 16 Circular Letters have been published.

The VIII International Soil Classification Workshop was held in Brazil on Oxisols in May, 1986. Approximately 70 fulltime participants attended the workshop, which included both paper sessions and examination of Oxisols in the field. The field tour was conducted between Sao Paulo and Brasilia. where 22 pedons with complete characterization data were examined and classified. The purpose of the workshop was to help solve the remaining problems with the Oxisol proposal. I thought the workshop was very successful. and good agreement was reached concerning the final format of the proposal.

Acceptance of the ICOMOX proposal will have little impact on the classification of the soils of the United States, because the SCS only recognizes about 39 soil series classified as Oxisols. These are in Puerto Rica, Hawaii, the Trust Territory, and Guam. It appears, however, that all 39 series will require reclassification.

<u>The International Committee on Andisols</u> was established in 1978 after Guy Smith prepared a report recommending that a new order, Andisols, be established. Progress has been steady with this committee, and hopefully it will submit its final proposal to SCS by late 1987.

Two events have been scheduled to aid in finalizing decisions. The first is an International Soil Correlation Meeting which will be held July 20 to 31, 1986 and will be the first such meeting held of this type. At this meeting we will concentrate on examining a wide range of "Andisols" in Idaho, Washington, and Oregon. Participation in the International Correlation Meeting is restricted to about 40 people mostly for logistical reasons - one being that only one bus will be required. The correlation meeting will not be as "international" as the workshops, in that only 4 other countries will be represented besides the U.S. Most of the participants will be from the West or Northwest.

The second event is the 9th International Soil Classification Workshop scheduled for July, 1987 in Japan. At this workshop decisions should be made on all remaining problems with the ICMAND proposal, and the final proposal is expected to be received by the SCS in the fall of 1987.

<u>The International Committee on Moisture Regimes</u> has been "on hold" for the last 3 or 4 years. In 1982 the committee had decided that they had done about as much as they could do based on the current research on soil moisture at that time. SCS has not followed up on the committee's proposals. The proposals consisted basically of subdividing the existing soil moisture regimes into three subclasses each. We are trying to revive the committee to either develop a new model or improve the Newhall Model. It is generally felt that we could test the ICOMMORT proposal, but we need a better mechanism or applying the limits when making soil surveys.

Ron Paetzold is working on soil moisture and temperature regimes and is making an inventory of the ongoing and completed studies conducted in the U.S. He will also help evaluate existing models to determine if it is practical to use or modify them for use to estimate soil moisture and temperature regimes. Two possible models are the SPAW model developed by Keith Saxon of Pullman, Washington, and the CREAMSTAX model, which is a modification of the CREAMS model.

<u>The International Committee on Aridisols</u> has progressed slowly. The third International Soil Classification Workshop was held in Syria and Lebanon in 1980 to address the taxonomy of soils in arid zones of low latitudes. The workshop was quite a success as far as identifying problems in the management and classification of these soils. but there was a lack of significant follow-up by ICOMID. Recently there has been an increase in activity, and currently there are plans to hold an International Soil Correlation Meeting on Aridisols in 1987 in the Southwestern part of the U.S.

In the past the committee concentrated on Aridisols with accumulations of carbonate and gypsum and tried to define a couple of new diagnostic horizons, the hypergypsic and hypercalcic horizons. Now there is a more general feeling that the whole order should be examined. At present there are only two suborders recognized, but if the Orthids, for example, were split into Calcids, Gypsids, Salids, etc., more meaningful groupings could be made at the great group and subgroup levels.

The International Committee on Vertisols is completing its mandate, and the chairman is preparing the final ICOMERT recommendations to be submitted to the SCS. After receiving the recommendations we will send them out for worldwide testing.

Some of the major changes being recommended by ICOMERT are: Deletion of gilgai as a criterion for recognizing Vertisols; introducing an aquic suborder; discontinuing the use of pellic and chromic great groups based on color and introducing dystric, eutric, duric, and salic great groups.

The International Committee on Wet Soils had a slow start under the chairmanship of Frank Moormann. He gathered a lot of introductory information but never had the time to prepare a circular letter. In 1984 he submitted his resignation as chairman and recommended that Johan Bouma be designated as the new chairman. We followed up on his recommendation.

Since Johan became chairman, he has distributed 4 Circular Letters and generated a lot of responses. Some of the major questions are: (a) Should the aquic moisture regime be defined on the basis of saturation only or should it require saturation and reduction? (b) Should the pseudogleys be distinguished from the groundwater gleys at a high level? (c) Should drained soils be distinguished on the basis of taxon criteria or phase criteria? (d) Should soils that are saturated for periods of time, but do not become reduced be recognized at the subgroup level? (e) Should morphometric criteria be used to define aquic suborders, or should they be identified on the basis of measured periods during which they exhibit reducing conditions or on the basis of depth and season of watertable? Dr. Bouma is planning to complete his mandate by 1988.

The International Committee on Spodosols has had a difficult time. Ted Miller was selected as chairman when the committee was first established. He resigned, however, when he retired from the SCS, and Bob Rourke accepted the chairmanship. A large Spodosol data base has been established, and the data base is being manipulated to test different hypotheses. A major problem, however, is that the data base, for the most part, is based on our standard soil analyses, and it has been manipulated to death over the last 20 years. We need new analyses to test the Spodosols, and certain Universities and Countries are trying new analyses but they are very expensive to screen. Some of the new test may give good separation among the local soils tested, but the tests disintegrate when a wide spectrum of soils are used. The only thing on which we can get good agreement is that if it looks like a Spodosol we should classify it as a Spodosol.

This completes my discussion of the established ICOM's. Recently, however, we have received recommendations to establish two more ICOM's, one on soil families and the other on Histosols. The one on soil families would be a follow-up to Ben Hyjak's work on soil families. The other would be to fill in gaps in the Histosols at lower latitudes.

At one time it was thought that additional committees should not be established until most of the established ones had completed their mandates. Overall, I think the committees have been quite successful. It is not a very efficient approach to improving Soil Taxonomy, but I do not know a better one.

Group Discussion and Questions ---

INTERNATIONAL COMMITTEES ON SOIL TAXONOMY

ICOMLAC - International Committee on Soils with Low Activity Clay

Or. Frank Moorman, Chairman 1976-1984. Fourteen newsletters. The final report or proposal was written by Dr. Richard Guthrie. Now being checked by Dr. John Witty. Will have Kandi great groups at less than 16 meq/100 grams clay. We will need subgroups at less than 24 meq/100 grams of clay in Mississippi, Louisiana, Texas and Arkansas.

ICOMOX - International Committee on Oxisols

Dr. Stanley Buol, Chairman, who took over from Dr Harry Eswarin a few years ago.

ICOMID - International Committee on Aridisols

Dr. A Osman. Chairman. Several newsletters. The last proposal sent by Nichols to representatives in Oklahoma and Texas, December 3, 1985. If you want a copy, let me know. We are proposing a U.S. tour in September or October of 1987 and hope to make it International in scope. Before that tour we need to do some work to get "our act" together here in the U.S.

ICOMERT - International Committee on Vertisols

Dr. Juan Comerma, Chairman. Four newsletters. Possibly close to a proposed amendment.

ICOMAND - International Committee on Andosols

A tour in the western U.S. July 20-31, 1986.

ICOMAQ - International Committee on Soils with Aquic Moisture Regimes.

Dr. J. Bouma. Chairman. Three circular letters. This is a very important committee for the South. I propose a tour for us to get our ideas together.

ICOMOD - International Committee on Spodosols

F. Ted Miller (now retired), Chairman. Several newsletters. Possibly close to a proposal.

JOE D. NICHOLS

## COMMITTEE I - SOILS LABORATORY DATA BASES

1986 Southern Regional Technical Work-Planning Conference of the National Cooperative Soil Survey.

Chairman: C.A. Steers

Vice-Chairman: R.H. Griffin

Members: K. Bates
E. R. Blakley
V. W. Carlisle
P. Daugherty
D. C. Egley
R. H. Griffin
C. T. Hallmark
A. D. Karathanasis
D. E. Lewis, Jr.
M. Mausbach
J.C. Meetze
H. F. Perkins
L. Ratliff
B. N. Stuckey, Jr.
B. J. Wagner
C. Wettstein

| Data Base Areas | Resource Persons |
|---|---|
| Physical and Chemical | R. H. Griffin and Dorn Egley |
| Mineralogy | Tom Hallmark, Ben Hajek, A. D. Karathanasis, Warren |
| Engineering | Lynn |
| CAMPS Project | Earl Blakley and representatives from North Carolina, Alabama, and Arkansas |
| System 2000 project | DeWayne Williams |

Committee 1 - Soils Laboratory Data Bases

Charge 1. Develop an updated status report and summary of data bases currently used in formatting and cataloging available laboraory data.

Physical and Chemical Data

The National Soil Survey Laboratory (NSSL) in Lincoln, Nebraska has laboratory data stored in three different formats. These data are stored on the Nebraska statehouse computer. For all three data formats, a program is available that will print a characterization data sheet in 102 column format. For data collected since 1978 an interactive program has been developed by the NSSL that can print several styles of data sheets and produce an ASCII dump of the file in 80 column format. Newer portions of this program are still in the testing state.

At this time the data on the Nebraska statehouse computer can only be accessed by SCS personnel through 1200 baud asynchronous dial up ports. No high speed asynchronous cabilities are available to anyone at this time. This program could conceivably be made available to cooperators through "Agnet", which is also based on the Nebraska statehouse computer, but this option is not being pursued at this time.

All NSSL Laboratory data are stored in unformatted direct access files. Data stored in this format cannot be easily transferred from one computer system to another. The IRM staff at the SCS South National Technical Center is working with the NSSL to combine all three NSSL forms into a common sequential ASCII format. This work is being done on the USDA computer in Washington, D.C. and will require about one more year to complete.

Engineering Data

At the present time engineers in the SCS have two data base programs for engineering soil test data. However, neither has received extensive use.

A system was developed for storing soil mechanics data on the Harris. However, due to severe limitations for manipulation of the data, the system received very little use. Recent efforts to reactivate it have been unsuccessful and the program has probably been destroyed.

The West NTC is presently using the Symphony spreadsheet package on an IBM PC for engineering data. The SNTC SML has not attempted to use it because of a lack of hardware at a convenient location.

We have obtained soil engineering test data (ESTD) from State Highway Department and SCS Soil Mechanics Laboratories during the coarse of progressive soil surveys for many years. Most of the data was made a part of the published soil survey reports and were used to develop the "Estimated Soil Property" section of the soil interpretation records for soil series.

During the time frame of about 1975 to 1978 a computer program was available for entering, storage and report generation (Table R) for the data. Data from about 679 pedons were entered into the Washington Computer Center. The program became inoperative in about 1978 and recent efforts to revise it have not yet been successful.

The following is an estimate of the amount and format of these data in the SNTC:

a. From about 1979 to the present the ESTD were encoded on Form SCS-SOI-10, revisions 10/78 and 5/82 (examples are attached). These forms are very similar but have some differences in the "B" lines. There are about 400 sets of data in these formats on file at the SNTC Soil Staff and about 200 additional sets were forwarded to the NSSL. This data was checked during the final correlation process and can readily be entered into computer storage.

b. From about 1975 to 1979 the ESTD were encoded on Form SCS-SOI-IO dated 9/74 (attached). This form differs from the later revisions by not having most of the "B" line information required to generate a complete data index. About 600 sets of data in this format were sent to the NSSL. Some updating of these forms will be required before entering into computer storage. It was in this time frame that part of the data was entered into the WCC. Some states stored data only from ongoing soil surveys whereas others entered data from both ongoing and previously completed survey areas. The status of the stored data is not known but a listing of pedons entered by each state is available.

c. Based on a quick inventory of our files, there is an estimted 1,200 sets of data that have not been recorded on SCS-SOI-IO forms. Most of this data is in table form suitable for publication in a soil survey manuscript and most were published in the county soil survey reports. The encoding of this data will in most cases, require checking of the correlation and the addition of "B" line information.

Index of Soil Laboratory Data (SOI-B)- SNTC

1. NSSL Data - In April, 1984 the states were sent a printout of laboratory data and facsimile SOI-8 forms for 611 pedons proceesed from 1978-1982. They were asked to update the SOI-8 and return them to the NSSL for use in updating the Soil Survey Investigations Index. All but three states have completed their review. Since this update we have made an effort to review and complete all SOI-8 forms submitted during the review of field correlations and forward a copy to NSSL. With the exception of the 1978-82 data from three states the index should be current.

2. State Experiment Station Data - The states are completing SOI-8 forms for state data at the time of final correlation. Since about 1981 we have maintained a copy of these forms at the SNTC. They have been checked and can readily be entered into a data base index similar to that used by the NSSL.

CAMPS Project

The Computer Assisted Management and Planning System (CAMPS) is designed to facilitate operations in USDA Soil Conservaton Service (SCS) field offices by providing a set of integrated, computer assisted tools for use by District Conservationists and their staff. CAMPS is based on the concept of a central database containing most of the data elements used in daily operations. Supporting this database is a collection of computer software that organizes, maintains, and presents the data in an effective, easy-to-use manner.

At present, the two major parts, or “data sets” of the central database are the Client Operating Records (COR) and the Soil Survey Area data (SOILS).

The Basic Data Sets

COR - The COR database was developed to enable field offices to store, retrieve, and report data about their clients’ conservation needs and the field office’s accomplishments.

SOILS - The SOILS database integrates most of the commonly used types of soils data making the data easier to use in decision making processes. The database is derived from the data fields used in the soil survey, the SOI-5 and the SOI-6. These files are combined in a national database called the National Soil Survey Database. Data for the county or counties served by a field office are downloaded from the national database as single phase interpretations to create a standard SOILS database for the field office.

The map unit symbol is the major link between SOILS and COR. COR provides a list of the map unit symbols for a client’s field. SOILS supplesies extensive soil data for each map unit for use in evaluation and planning.

Currently there are no laboratory data in CAMPS, but the system does allow for the development and inclusion of modules to handle laboratory data.

Mineralogy Data

The Southern Regional Research Committee S-152 reviewed the final report "A Review of the Family Category in Soil Taxonomy" which has been distributed and is available through Ben Hajek, Auburn University. We have attached the Annual Progress Report of the Southern Regional Research Committee S152 for your use. As you will note this report, under, the section "Work needed for Completion", provides very specific items used for laboratory data and proposed suggestions for data transfer.

System 2000 Project

Two databases are located at the USDA Fort Collins Computer Center (FCC) that use System 2000 (S2K) database management software.

Databases are National Soil Survey area database (NSSAD), SOILS-5 Interactive Database (SOILS-5).

The NSSAD combines the SCS-SS-6's and the SOILS-5 forms in the U.S. Any information the SOILS-5 form is available through interactive terminals via telenet.

In addition, two demonstration databases are available. One is SOILS which is the soil survey demo database and consists of the 11 counties tested in the first CAMPS trial. The second one is FIVE which is the SCS-SOILS-5 demo database and consists of the first SOIL-5 record numbers in each state. These are designed to test query commands.

Charge 2. Serve as a sounding board to respond, aid, supplement and review efforts of the SCS South National Technical Center as formats are chosen and software developed for data storage on a regional or national level.

Physical and Chemical Data

The effort to combine and edit the three NSSL data sets is an intermediate step in creating a combined national database that includes data from National Cooperative Soil Survey State Laboratories. The final format for all parts of this combined intermediate databse have not yet even been determined. However, any information we can get from the NCSS cooperator concerning their automated systems and types of output will aid us in designing an intermediate system that will require the least amount of modification in adapting it to a national system.

In April a letter was sent to the Southern Region NCSS State Laboratories asking for any information they would be willing to provide about their existing data systems and output. Of great importance at this time are examples of each states pedon characterization data sheets, what analysis and methods the state labs use, and any coding schemes used in their computerized databases Using the received state lab reports as sample sets of data, the work of consolidating state data within a centralized data system seems practical and achievable. All states will provide IRM staff with such sample reports.

Engineering Lab Data

Charlie McElroy, Lorn Dunnigan, and Dorn Egley met on July 24, 1985 to discuss engineer databases. Their decision was to wait until the SOILS Lab database that Dorn is working on is finished and modify it for engineer data and use. It was agreed that complex engineer database data needs to be kept separate from SOILS data.

State Soil Survey Database (35D)

A major component of CAMPS is the soil database. The validation and subsequent downloading downloading of the soil data to the field office system will eventually be the responsibility of the state. In order to facilitate this activity, state soil databases will be developed.

Plan are to begin testing the alpha version of 3SD's using FOCAS equipment now in place in five state SCS Offices. Test will be done in June and July, 1986. If all goes as planned, the system will be available to all states for implementation in the fall, 1986.

The test will be in the following states: California, Colorado, Kansas, Arkansas and Maine. Test will also be done at the NTC's.

During the pilot tests, data will be downloaded from the soils databases at the Fort Collins Computer Center. Later, the data will be downloaded in 3SD's directly from the soils databases at Iowas State University, Ames, Iowa.

Each test state will be provided the following data sets:

- SOILS-5 data for all soils owned by the state
- series descriptions (OSEDS) for all series used by the state
- map unit records for at least 5 survey areas

At this time the 3SD database does not contain any laboratory data, but modules will be developed to provide for its inclustion.

It is suggested that the committee consider and make recommendations on the following items concerning the Engineering Soil Test Data (ESTD/SOI-10)

1. Does the projected use of ESTD warrant development of a data base?

2. What priority should be placed on its development relative to other data bases?

3. What are the anticipated use (outputs)?

4. What form of database will best accomodate the uses?

5. What hardware (Harris, FOCUS, etc.) should be used?

6. Who should coordinate the effort?

7. Who will have access?

RECOMMENDATIONS:

1. Continue and complete reformating of the 3 combined NSSL data files. Retrieval techniques will be provided on USDA Washington computer and access to files can be made via batch requests or user written SAS or Easytrieve programs. Tape copies of the data set, along with the necessary documentation could be provided for SCS and NCSS cooperator use.

2. Reformat state characterizaton data files and imcorperate with NSSI. data providing a centralized laboratory data file. This will be accomplished by selecting trial states for reformat testing and development guidance will be provided by this committee or other similar appointed committee.

3. That this committee be continued to carry out recommendation in 1 and 2.

4. That this committee report be accepted by the South Technical Work-Planning Conference body.

ANNUAL PROGRESS REPORT
SOUTHERN REGIONAL RESEARCH COMMITTEE
S-152

ALABAMA AGRICULTURAL EXPERIMENT STATION

Project: Significance and Distribution of Mineral Components in Souther Soils

Department: Agronomy and Soils Department. Auburn University, Alabama

Personnel: Ben F. Hajek

Nature of Research and Principal Results:

The soil mineral map was revised and many correlation decisions were made. A new work copy was drafted on which are included each state's map unit symbol consists of a letter or letters representing mineral assemblage names. The names are given in the attached mineral map legend.

Definitions of mineral assemblage classes are in the attached copy of a portion of a final report on soil family criteria. The report was prepared by B.F. Hajek for the Soil Conservation Service. Some committee members may have this report as it has received wide distribution.

Work Needed for Completion:

Included in each report to the state, there is a copy of your state mineral map and a table report of map unit symbols, asseblage symbols, coarse mineralogy, fine mineralogy symbols, regional soil association symbols for the delinations and MLRA symbols. Each state representative should review the correlations made by me, often with benefit of little data and knowledge of the area, and revise them and delination lines if needed. Change the cap letter assemblage class to one that best represents the mineral components in the three or four soils that are most extensive in the area represented by the delination. Dominant soils have been supplied to you earlier. They were given by MLRA, based on the most recent NRI.

Chemical, physical, and mineralogical data were obtained for major soils in MLRA'S with the assistance of USDA-ARS, SCS personnel at Temple, Texas and the SCS staff at Lincoln, Nebraska. When map unit assemblage classes are revised and resubmitted to the chairman, the NSSL data will be sorted by class and the floppy disk will be distributed for review.

The following is a description of the National Soil Survey Lab data file planned for inclusion on disk in the regional mineral map document.

The NSSL soil data proposed for distribution on floppy disk is a subset of the main NSSL data set. Two selections were made on the main data set. The first selected by MLRA for malor soils found in the Southeast region of the United States. The second selected only certain information fields from those in the NSSL data set. The fields selected (in order) were: upper depth, lower depth, clay, silt, sand, carbon, iron, calcium, magnesium, sodium, potassium, aluminum, NH4OAC CEC, CaC03, $H_2O$ ph, 1/3 bar water, 15 bar water, NSSL sample ID, state, series, MLRA, subgroup, (family - particle size, mineralogy, reaction, temperature), clay pH 7 CEC, clay ECEC, and mineralogy codes.

The data file is on a 5 1/4 inch MS-DOS2.xx 9 sector double sided, double density diskette (360 K). It occupies about 186 K bytes. The internal file strucure is one line per record comma separated data. Extra spaces have been removed from all fields except mineralogy, so line lenghts are variable. The longest lines are around 220 characters. An entry is present for all fields in each record, so it is relatively easy to modify the data format. (Dummy entries in numeric fields are zeros, spaces are used in text fields). Three sample records are shown below. All have been split to fit on an 80 column page. No state laboratory data has been submitted.

```
27,50,56.1,15.9,28.0,0.6,2.6,10.8,8.2,0.2,0.9,0.6,25.1,0,5.3,25.2
,19.3,
790947,TX,BONTI,080,AUSPAUL,126,34,2,18,44.74,36.90,15KK
4MI 3MM 2**25KK36**53QZ91FK 6FP-10P
1CL-1BT--1EP-1ZR-**65KO22FO63
```

```
27,57,60.4,35.9,3.7,0.3,0.1,9,1.9,0,0,0,2.6,6.16.8,0.4,6.0.2
2.4,833371,
KY.FREDERICK.128.UUDPAAA,114,34,2,16,27.81,17.55, 15KK 3MI
3VR 2QZ 1**25KK30**54QZ86BT 3TM 30P 3MS 3FK 2ZR
1PO-1**65F079
```

```
151,195,54.5,25.4,20.1,0.1,0,6.6,6.3,0.9,0.2,0.6,18.7,0,5.4.
0,21.1, 833440,KY.
NICHOLSON,121,AUDFRAA,106,34,2,16,34.31,26.79, 15KK 4VR 2MT
1**25KK44**54QZ85BT 40P 3MS 3FK 3ZR 1AM-1TM-1**65FO8OKO 8
```

## COMMITTEE II -- LABORATORY METHODS AND ANALYSIS

Committee Members:

| | |
|---|---|
| B. R. Smith, Chairman | G. L. Hickman |
| H. H. Bailey | J. H. Kimble |
| R. I. Barnhisel | W. C. Lynn |
| B. J. Carter | C. H. McElroy |
| M. E. Collins | I. Ratcliff |
| C. A. Ditzler | R. Rehner |
| B. F. Hajek | J. M. Robbins, Jr. |
| W. G. Harris | L. P. Wilding |

Charge 1. Develop a system for exchange of laboratory samples among laboratories in the South Region with the objective of determining variability within and between laboratories for common procedures.

A. Response to Charge 1.

A questionnaire was distributed to the soil survey characterization laboratories in the states of the South Region. The questionaire asked if personnel of the labs would participate in a" exchange and analysis of soil samples, how many samples each state should contribute to be exchanged, what analyses should be performed and the methods that should be used for the analyses, whether the labs routinely use procedures and methods that are different from those in Soil Survey Investigations Report No. 1 (SSIR 1), and to list those that are different and how they differ. Responses were received from 11 of the 12 states, and 10 states indicated that they would participate in a" exchange and analysis of soil samples. Most respondents suggested that each state contribute 1 or 2 samples to such a" exchange, although two suggested 3 to 5 samples. Analyses and methods suggested are listed in Table 1. Respondents all indicated that for most analyses they used SSIR 1, with very minor modifications in some cases. Other methods are used for selected analyses by a few labs.

TABLE 1. Analyses and Methods Suggested for Soil Sample Exchange.

| Analyses | Methods* |
|---|---|
| Particle size | 3A1<br>Hydrometer-Day<br>(one state) |
| CEC | 5A1<br>Method 19-Ag Handbook 60<br>(one state) |
| Sum of cations | 5A3a, 5A3b |
| Extractable bases | 5A1 |
| Ca | 6N2e |
| Mg | 602d |
| Na | 6P2b |
| K | 6Q2b |
| Extractable acidity | 6H1 |
| Base saturation | 5C3 |
| Extractable Al | 6Gle |
| pH | 8C1a, 8C1c, 8Cle |
| Organic carbon | 6A1a, 6A2<br>Dry combustion-Nelson & Sommers (one state) |
| CaC03 equivalent (three states, on samples where appropriate) | 6E1e<br>Gasometric-Dreimanis (one state) |
| Electrical conductivity (two states, on samples where appropriate) | 8A1a, 8A3a |
| Comparison of air-dried vs. moist samples for soils of marshes for analyses of exchangeable cations, pH, and EC (two states, on samples where appropriate) | |
| Clay mineralogy | Methods currently used by each characterization lab |

• SSIR 1, 1972 Revision unless otherwise stated

It was decided to use the methods and procedures contained in SSIR 1, 1972 revision, rather than those in SSIR, 1984 revision. Some of the analyses outlined in SSIR 1, 1984 revision, require the use of an automatic extractor, and several of the laboratories in the South Region do not have an automatic extractor.

B. Recommendations for Charge 1.

It is recommended that a limited sample exchange be done among the characterization laboratories, including the National Soil Survey Laboratory, in the South Region. The soil samples to be used will be selected from those in the reference set collected by the soil mineralogy work group and that are now stored in the agronomy department at the University of Kentucky. Approximately 10-12 of these soil samples will be used for the exchange.

Analyses to be performed will be those listed in Table 1 that are required to determine chemical, physical, and mineralogical properties of the samples. Results will then be statistically analyzed. Each laboratory should prepare a list of the exact procedures used for the various analyses. This will allow comparisons among the characterization laboratories to see if there are any variations from the procedures in SSIR 1, 1972 revision. There will certainly be differences in techniques from determination of clay mineralogy of the samples because of differences in equipment among the participating laboratories.

Charge 2. Develop a procedures and methods manual that would be adopted as a standard for use by the characterization laboratories in the South Region.

A. Response to Charge 2.

The questionnaire that was distributed also asked whether personnel of the labs would be interested in helping to develop a manual for the region for routine analyses. Of the 11 responses received, 3 indicated an interest in developing a manual and 8 indicated no interest in developing a manual. The consensus of opinion was that a new manual was not needed. Rather, the consensus was that all of the characterization labs in the region should use SSIR 1 as the procedures and methods manual. Several respondents suggested that a" additional manual would make interpretation and comparison of soil data even more difficult, and would tend to thwart efforts to develop a national characterization data base.

B. Recommendations for Charge 2.

It is recommended that no new procedures and methods manual be developed for use in the South Region. SSIR 1 is the manual that should be used for characterization of samples for the cooperative soil survey program in the region.

It is further recommended that the procedures and methods in SSIR 1 be adopted by the American Society for Testing Materials (ASTM) as standards for soil characterization. The National Soil Survey Laboratory should take the lead in getting SSIR 1 adopted as standards for soil characterization by ASTM.

## GENERAL RECOMMENDATIONS

It is recommended that this committee be continued until such time as the analyses have been completed and statistically analyzed and the results have been published.

## COMMITTEE III - SOIL INTERPRETATIONS

Committee Membership: DeWayne Williams, Chairman

R. L. Blevins
J. F. Brasfield
L. C. Brockmann
R. B. Brown
G. J. Buntley
E. L. Cole
S. Coleman
T. Coleman
W. H. Craddock
J. L. Driessen
R. T. Fielder
W. Frye
C. L. Fultz
D. C. Hallbick
B. L. Harris
E. N. Hayhurst
A. Hyde
H. J. Kleiss
J. D. Nichols
W. E. Richardson
J. M. Soileau
C. M. Thompson
K. Wells

Charge I. Develop rating guides for selected uses that are not currently being rated.

A. Response to Charge I

The committee used the suggestion of the steering committee to develop draft rating guides for no-till and herbicide use. In addition, the committee added soil reconstruction material. These three drafts are presented here as Table 1 - No-Till, Table 2 - Features Affecting Herbicide Selection and Usage; and Table 3 - Soil Reconstruction Material.

# NO-TILL

No-till is a type of conservation tillage. The soil is left undisturbed prior to planting. Planting is completed in a narrow seedbed approximately 1 to 3 inches wide. Weed control is accomplished primarily with herbicides.

Those features important in no-till operations are wetness or ponding and the need for drainage, texture. flooding, available water capacity, permeability, salinity, sodicity, coarse fragments, susceptibility to water erosion and slope.

TABLE 1. NO-TILL

| PROPERTY | LIMITS | FEATURE AFFECTING |
|---|---|---|
| 1. Depth to water table (Ft) | < 1.5 | Wetness |
| 2. Ponding | + | Ponding |
| 3. Flooding | Common | Flooding |
| 4. USDA Texture (Surface layer) | SC, SIC. c | Clayey |
| | COS, S, LS, LFS, LCOS | Sandy |
| | Muck, Peat | Excess Humus |
| 5. Organic Matter Content (%) | < 2<br>> 6 | Chem. Action |
| 6. Permeability (IN/HR)(O-20 IN) | < 0.06 | Percs Slow |
| 7. Erosion Factor (K X % slope) | > 2 | Erodes Easily |
| 8. Sodium Adsorption Ratio (0 - 40") | > 12 (Natric) | Excess Sodium |
| 9. Salinity (0 - 20 IN) | > 4 | Excess Salt |
| 10. Soil Compaction (Surface layer) (g/cc) | | Compaction |
| Sandy | > 1.85 | |
| Coarse-loamy | > 1.80 | |
| Fine-loamy | > 1.70 | |
| Coarse-silty | > 1.60 | |
| Fine silty | > 1.60 | |
| Fine | > 1.50 | |
| Very fine | > 1.35 | |
| 11. Fraction - 3IN (wt. Pct) (Surface layer) | > 15 | Large Stones |
| 12. Available Water Capacity (IN/IN) 1/ | < .10 | Droughty |
| 13. Soil Reaction (pH) (Surface layer) | < 4.5<br>> 7.4 | Acid<br>Alkaline |

1/ weighted average to 40 inches

## HERBICIDE USE

A herbicide is an agent used to destroy or inhibit plant growth. A number of herbicides are currently on the market and some are rather plant selective.

Those features important in herbicide use are texture, organic matter, and soil reaction. Other features considered are wetness, flooding and susceptibility to wind and water erosion.

TABLE 2. FEATURES AFFECTING HERBICIDE SELECTION AND USAGE

| PROPERTY | FEATURES AFFECTING |
|---|---|
| 1. USDA Texture (Surface Layer) | COS, VFS, LCOS<br>S, LS, LFS, FS<br>LVFS<br><br>Muck, Peat |
| 2. Organic Matter Content (%) | $< 2$<br>$> 6$ |
| 3. Depth to High Water Table (FT) | $< 1$ |
| 4. Flooding | Common |
| 5. Soil Reaction (pH) | $> 7.4$<br>$< 4.5$ |
| 6. Erosion Factor (K x % slope) 1/ | $> 2$ |

1/ may present a pollution hazard

## SOIL RECONSTRUCTION MATERIAL

Soil reconstruction material is used for upper four feet in post-mined areas. The purpose in this rating is to predict the suitability of materials for use in the upper 4 feet following surface mining operations. Major consideration is given to factors that affect establishment of vegetation.

Those features important in soil reconstruction material are texture, soil reaction, available water capacity, salinity, sodicity, susceptibility to wind or water erosion, cation exchange capacity, organic matter and coarse fragments. Because much of the material to be rated may come from considerable depths, toxic materials and acid-base balance is considered.

TABLE 3. Soil reconstruction material to be used for upper 4 feet in post-mined areas.

| PROPERTY | LIMITS | | | RESTRICTIVE FEATURE |
|---|---|---|---|---|
| | GOOD | FAIR | POOR | |
| 1. Sodium Adsorption Ratio | < 5 | 5-12 | > 12 | Excess Sodium |
| 2. Salinity (MMHOS/CM) | < 8 | 8-16 | > 16 | Excess Salt |
| 3. Toxic Materials | Low | --- | High | Toxicity |
| 4. Soil Reaction (pH) | 5.6-8.3 | 4.5-5.5 | < 4.5 | Too Acid |
| 5. Available Water Capacity (IN/IN) | > .10 | .05-.10 | < .05 | Droughty |
| 6. Erosion Factor (K) | .15-.24 | .28-.32<br>< 15 | > .32 | Erodes Easily |
| 7. Wind Erod. Group | ----- | 3, 4L | 1, 2 | Soil Blowing |
| 8. USDA Texture | | SCL, CL | 5/ C,<br>5/ SIC,<br>5/ SC | Too Clayey |
| 9. USDA Texture | | LCOS, LS<br>LFS, LVFS | COS, S.<br>FS, VFS | Too Sandy |
| 10. Coarse Frag. (WT PCT) | | | | |
| 3-10 in. | < 15 | 15-35 | > 35 | Small Stones |
| 10 in. | < 3 | 3-10 | > 10 | Large Stones |
| 11. Potential Nutrient Availability (CEC) | > 18 | 10-18 | < | |
| 12. Acid-Base Balance | ≥ 0 | | | |
| 13. Carbonates | < 40 | | | |
| 14. Organic Matter | 7 1 | | | |
| 15. Layer Thickness (IN) | > 40 | | | |

cos.

B. Recommendations Pertaining to Charge I

The committee recommends that these guides be presented for testing. SCS and cooperators are encouraged to solicit response to these guides. The South NTC will serve as a clearing house to collect, review and act on responses.

Charge II - Summarize and report on the effective use of soil potentials in the south region.

A. Response to Charge II

The committee developed and sent out a questionnaire to each of the states in the south region. All twelve states plus the Caribbean area responded. Only one state had not completed any soil potentials. Four states have completed only one soil potential. The following is a summary of the questionnaire.

Number of Potentials

| | |
|---|---|
| Cropland * | 20 |
| Pasture | 134 |
| Woodland | 5 |
| Urban | 110 |
| Septic System | 60 |
| Range | 19 |
| Orchard | 1 |
| Other Specialty Crops | 3 |
| Total | 352 |

* Most states have developed "quick" potentials for LESA. These are in addition to this total.

Users

Croplands

| | |
|---|---|
| - SCS (and extension agents & SCD's) | 7 |
| - LESA | 2 |
| - County planning | 2 |
| - Consultants | 2 |

| | |
|---|---|
| Woodland | |
| - County planning | 1 |
| - SCS | 2 |
| - Not yet known | 1 |
| - Consultants | 1 |
| Urban | |
| - County planning | 5 |
| - Federal agency | 2 |
| - Not yet known | 1 |
| - Consultants | 1 |
| - Contractors | 1 |
| Septic System | |
| - County sanitarians and planners | 7 |
| - Contractors | 1 |
| Other | |
| - Specialty crops | 2 |
| - Orchard crops | 1 |
| Rangeland | |
| - Not yet known | 1 |

Comments:

- Results were split about 50/50 on effectiveness (and/or use) of soil potentials.

- SCS still seems to be the biggest user of potentials--both for LESA and planning purposes.

- One state reports demand for potentials, but no time for their development.

- All seem to agree that best use of potentials is made when large numbers of users help in their development.

- Interpretative maps could be very useful to promote soil potentials.

- Potentials are a positive approach rather than the negative that is used in many soil survey reports.

- Potentials can be developed as supplements to older soil surveys.

B. Recoannendations Pertaining to Charge II

The committee has no specific recommendation concerning this charge other than to encourage the development and use of soil potentials.

Charge III - Evaluate Soil Properties Record developed for Texas MLRA 77 and recommend applicability for national use.

A. Response to Charge III

The committee reviewed the subject document prior to and during the meeting. There was general agreement that the Soil Properties Record is an excellent vehicle to gather and record agronomic, engineering and other needed information for a map unit under a specified use. Exhibit A contains the Procedures Manual for Soil Properties record.

The manual describes the format of the Soil Properties Record and explains each entry. Standard reference materials, locally developed guides, and computer based models may be employed to obtain the values of the entries. The basis for several entries is not available in current publications. For these entries, the explanation is quite complete.

B. Recommendations Pertaining to Charge III

The committee recommends that the Soil Properties Record be referred to the national committee and/or national headquarters for potential use especially in irrigated and highly intensified dryland farming areas.

Continuance of the Committee

It is recommended that the committee be continued to explore new or improved soil interpretations. Soil interpretations specific to forestry, range or horticulture could be examined by future committees.

EXHIBIT A

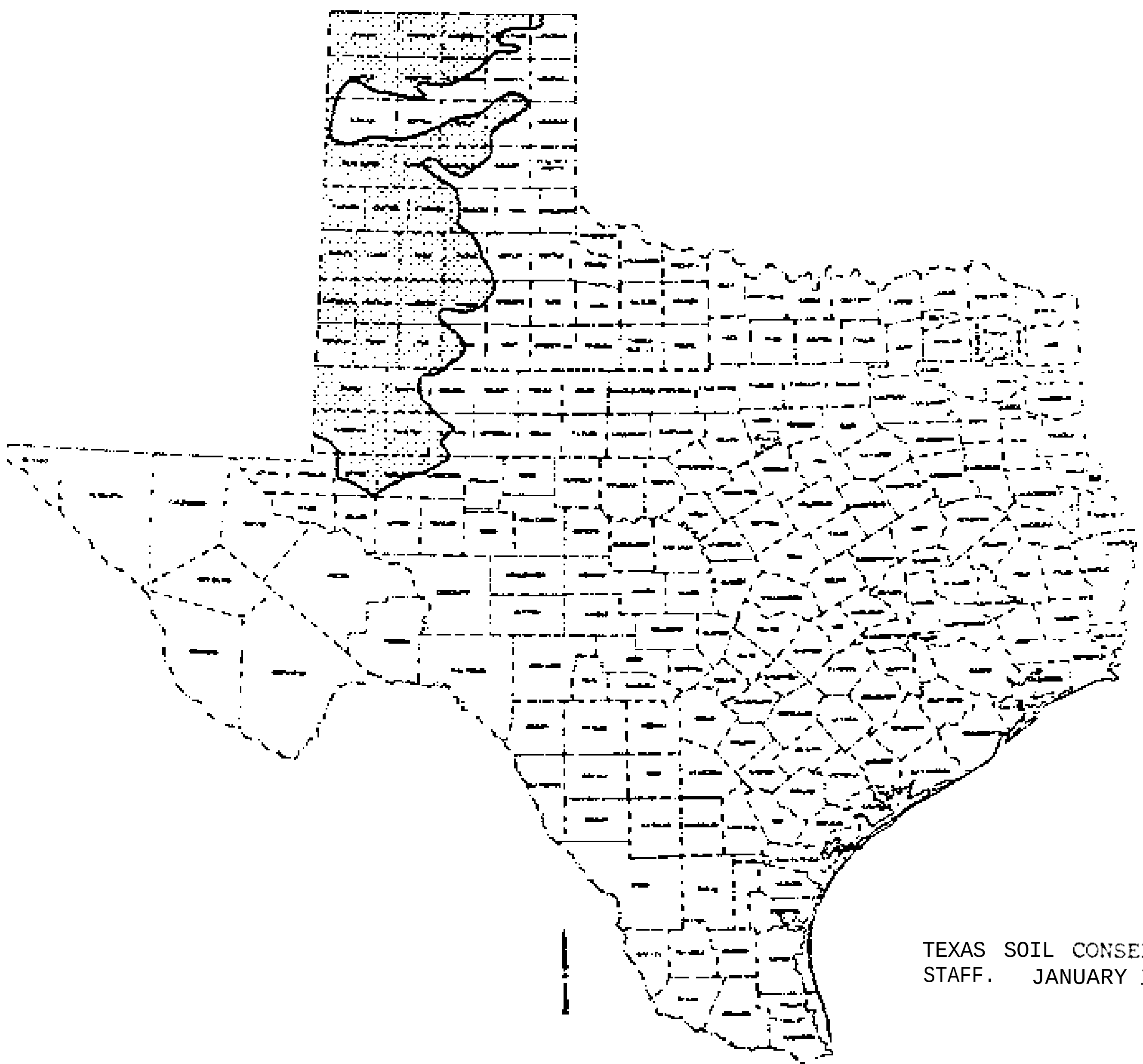
# PROCEDURES MANUAL

for

Soil Properties Record

Texas M.L.R.A. 77

VERSION 1



TEXAS SOIL CONSERVATION
STAFF. JANUARY 1986

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## INTRODUCTION

This manual is a guide for the assembly of Soil Property Records for the Texas portion of Major Land Resource Area (MLRA) 77. The location of MLRA 77 is show" on the cover. Display 1 is a Soil Property Record.

The Soil Property Record contains agronomic, engineering, and other information for a map unit of a soil survey area under a specified use. The records are intended to form part of the Field Office Technical Guide. They are completed in conferences of Soil Conservation Service field office personnel assisted by area and state office personnel. Records may be constructed for any soil use. This manual pertains principally to cropland.

The manual describes the format of the Soil Property Record and explains each entry. Standard reference materials, locally developed guides, and computer based models may be employed to obtain the values of the entries. The basis for several entries is not available in publications currently. For these entries, the explanation is quite complete.

The Texas High Plains, a" area about 150 miles wide by 340 miles long, makes up the southern part of the Great Plains of the United States. This area is nearly level to gently sloping, smooth and almost completely devoid of trees. It is broken only by numerous shallow vet-weather lakes, called playas, and a few shallow draws.

Rainfall in this area ranges from 16 inches in the west to 24 inches in the east. The rainfall is limited but very timely. Most falls just prior to and during the growing season. Selected weather data are in Display 2. Locations of the counties in Display 2 may be determined from Display 3.

Surface horizon texture of cropland soils ranges from fine sandy loams in the southwest to tight heavy textured clay loams in the north and east, which complicates water management.

Water for irrigation is almost exclusively restricted to a" extensive underground reservoir known as the Ogallala Aquifer. There are few surface water bodies that are able to provide a reliable source of irrigation water.

The Texas High Plains is a major contributor to Texas agriculture. Since 1970. the 10 million acres of cropland has produced 66 percent of the cotton, 53 percent of the grain sorghum, 72 percent of the wheat. and 82 percent of the fed beef produced in Texas. Approximately 64 percent or 6.4 million acres are irrigated.

Display I

# SOIL PROPERTIES RECORD

MAP UNIT Pullman Clay loam, [illegible]
PERMANENT PRACTICES
CALENDER YEAR USE Wheat
ROTATION Grain sorghum-fallow-wheat(irrigated)
WATER REGIME Average

LOCATION Carson County, Texas
RECORD NO. [illegible]
USE CODE [illegible]

OPERATION SCHEDULE

| | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prior year: | | | | | | | | | Drillwheat | Irrigate | Graze | Graze |
| Current year: | Graze | Graze | Graze to 3 [illegible] | | Irrigate | | Harvest Tandem Disk | Sweep 4" | Graze volunteer wheat through December 31 | | | |

| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | MAP UNIT DERIVED | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | VALUES ASSIGNED | USE DEPENDENT | | | | | | | | | | | | |
| 1 | Surface Crust - Resistance Thickness | [illegible] | [illegible] in. | | | A-2 | A-2 | A-2 | [illegible] | A-2 | A-2 | [illegible] | [illegible] | A-2 | [illegible]-3 | [illegible]3 | [illegible] |
| 2 | Upper Tillage Zone Thickness | [illegible] | Inches | | | 4 | [illegible] | [illegible] | [illegible] | [illegible] | 2 | [illegible] | [illegible] | 3 | [illegible] | [illegible] | [illegible] |
| 3 | Upper Tillage Zone Density | [illegible] | gm cc | | | 1.25 | 1.25 | 1.40 | 1.47 | 1.50 | 1.40 | [illegible] | [illegible] | 1.25 | 1.30 | [illegible] | 1.45 |
| 4 | Lower Tillage Zone Thickness | [illegible] | Inches | | | 3 | 3 | 3 | 3 | 3 | [illegible] | [illegible] | [illegible] | [illegible] | 3 | 3 | [illegible] |
| 5 | Lower Tillage Zone Density | [illegible] | gm cc | | | 1.35 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 6 | Upper Subsoil Density | [illegible] | gm cc | | [illegible] | | | | | | | | | | | | |
| 7 | Final Infiltration Rate | [illegible] | in. hr | | | 0.34 | [illegible] | 0.13 | 0.13 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 8 | Design Intake Family | [illegible] | | [illegible] | | | | | | | | | | | | | |
| 9 | Expected Net Furrow Intake [illegible] | [illegible] | Inches | | | 6.7 | 6.7 | 6.2 | 6.2 | 6.2 | 6.2 | [illegible] | [illegible] | 5.9 | [illegible] | [illegible] | [illegible] |
| 10 | Effective Hydrologic Group | [illegible] | | | | C | C | C | C | C | C | [illegible] | [illegible] | D | D | D | [illegible] |
| 11 | Antecedent Moisture Condition | [illegible] | | | | [illegible] | [illegible] | [illegible] | I | II | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 12 | Hydrologic Soil Cover Complex | [illegible] | | | | STPP | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 13 | Runoff Curve Number | [illegible] | | | | 87 | [illegible] | 73 | 73 | 56 | 72 | [illegible] | [illegible] | 90 | 70 | 73 | 78 |
| 14 | Depth Common Rooting Top Root | [illegible] | Inches | | | 38 | [illegible] | 30 | 30 | 30 | 32 | | | 5 | 14 | [illegible] | 16 |
| 15 | Depth Few Roots | [illegible] | Inches | | | 40 | 48 | 50 | [illegible] | [illegible] | [illegible] | | | [illegible] | [illegible] | [illegible] | [illegible] |
| 16 | AWC, Pct. of AWC State | [illegible] | in., Pct | 1.33 | [illegible] | 30%S | 30%S | 25%S | [illegible] | [illegible] | 25%S | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 17 | AWC, Pct. of AWC State | [illegible] | in., Pct. | 2.96 | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 18 | AWC, Pct. of AWC State | [illegible] | in., Pct. | 4.20 | | [illegible] | [illegible] | [illegible] | 25%S | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 19 | AWC, Pct. of AWC State | [illegible] | in., Pct. | 5.10 | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 20 | Total Avail. Water Capacity | [illegible] | Inches | 13.3 | | | | | | | | | | | | | |
| 21 | Avail. Water Present | [illegible] | Inches | | | 8.96 | 5.25 | 7.09 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 3.69 | [illegible] | [illegible] | [illegible] |
| 22 | Avail. Water Deficit | [illegible] | Inches | | | 4.34 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10.92 |
| 23 | Anticipated Yields | [illegible] | Bu/Ac | | 50 | | | | | | | | | | | | |

| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | MAP UNIT DERIVED | USE DEPENDENT: YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | VALUES ASSIGNED | | | | | | | | | | | | | |
| 24 | MEQ I | 021B.C01 | [illegible] | | | 21 | 21 | 21 | 21 | 21 | 21 | 12 | 12 | 12 | 21 | 21 | 21 |
| 25 | MEQ K | 022B.C01 | | | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 1.0 | 0.75 | 0.75 | 1.0 | 1.0 | 1.2 |
| 26 | MEQ C | 023B.C01 | | 80 | | | | | | | | | | | | | |
| 27 | MEQ S | 024B.C01 | Ft | 3000 | | | | | | | | | | | | | |
| 28 | MEQ P LSGFI | 025B.C01 | Cys./Ac | | | 500 | 800 | 1600 | 1000 | 5000 | 5000 | 3800 | 3400 | 3400 | 3400 | 3400 | [illegible] |
| 29 | MEQ Soil Loss | 023B.C01 | T/Ac/Y | | 0.33 | | | | | | | | | | | | |
| 30 | USLE R | 027A01 | | 170 | | | | | | | | | | | | | |
| 31 | USLE K | 028A01 | | 0.37 | | | | | | | | | | | | | |
| 32 | USLE L | 029A01 | Ft | 400 | | | | | | | | | | | | | |
| 33 | USLE S | 030A01 | Pct. | 0.50 | | | | | | | | | | | | | |
| 34 | USLE LS | 031A01 | | 1.13 | | | | | | | | | | | | | |
| 35 | USLE C | 032B.C01 | | | 0.12 | | | | | | | | | | | | |
| 36 | USLE P | 033A01 | | | 1.0 | | | | | | | | | | | | |
| 37 | USLE Soil Loss | 034B.C01 | T/Ac/Y | | 0.59 | | | | | | | | | | | | |
| 38 | Soil Condition Rating Index, Overall | 035B.C01 | +1.5 | | | | | | | | | | | | | | |
| 39 | Soil Condition Rating Index, Crop | 035B.C01 | 0.0 | | | | | | | | | | | | | | |
| 40 | Soil Condition Rating Index, Tillage | 037B.C01 | -0.4 | | | | | | | | | | | | | | |
| 41 | Soil Condition Rating Index, Mulch | 038B.C01 | - | | | | | | | | | | | | | | |
| 42 | Soil Condition Rating Index, Erosion | 039B.C01 | +2.0 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |

DATE
COMPILED BY

Display 2. Normal monthly and Annual Air Temperature (TEMP, °F), Potential Evapotranspiration (PE, inches), and Precipitation (PCPN, inches) for stations in the Texas portion of Major Land Resources Region.

| | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carson County; Panhandle | TEMP: °F | 37 | 41 | 48 | 58 | 67 | 74 | 78 | 76 | 69 | 59 | 47 | 39 | 58 |
| | PE: | .16 | .36 | 1.0 | 2.3 | 3.9 | 5.3 | 6.3 | 5.5 | 3.8 | 2.7 | 0.80 | .74 | 31.9 |
| | PCPN: | .48 | .76 | 1.3 | 1.1 | 2.1 | 3.7 | 2.7 | 3.1 | 2.0 | 1.8 | 0.88 | 0.64 | 20.6 |
| Dawson County; Lamesa | TEMP: °F | 40 | 44 | 51 | 62 | 70 | 78 | 81 | 79 | 73 | 62 | 51 | 43 | 60 |
| | PE: | .28 | .48 | 1.2 | 2.8 | 4.5 | 6.1 | 6.7 | 6.0 | 4.7 | 2.5 | 1.0 | .44 | 36.2 |
| | PCPN: | .60 | .48 | .92 | 1.0 | 2.2 | 2.3 | 2.6 | 1.7 | 2.8 | 2.1 | 0.68 | .36 | 17.8 |
| Deaf Smith County; Hereford | TEMP: °F | 35 | 39 | 45 | 55 | 65 | 73 | 76 | 75 | 67 | 57 | 45 | 38 | 56 |
| | PE: | .12 | .28 | .84 | 2.0 | 3.8 | 5.1 | 6.0 | 5.3 | 3.6 | 2.0 | .72 | .20 | 30.0 |
| | PCPN: | .40 | .40 | .88 | 1.0 | 1.6 | 3.2 | 2.4 | 2.5 | 1.8 | 1.7 | .72 | .52 | 17.3 |
| Hale County; Plainview | TEMP: °F | 37 | 42 | 48 | 58 | 67 | 75 | 78 | 77 | 69 | 60 | 47 | 40 | 58 |
| | PE: | .16 | .36 | .92 | 2.3 | 4.0 | 5.5 | 6.3 | 5.6 | 3.8 | 2.2 | .76 | .28 | 32.1 |
| | PCPN: | .48 | .60 | .96 | 1.2 | 2.7 | 3.5 | 3.0 | 2.2 | 2.5 | 2.0 | .48 | .64 | 20.4 |
| Lamb County; Littlefield | TEMP: °F | 39 | 42 | 50 | 59 | 66 | 75 | 78 | 75 | 68 | 59 | 48 | 41 | 58 |
| | PE: | .24 | .40 | 1.2 | 2.1 | 3.8 | 5.5 | 6.1 | 5.2 | 3.6 | 2.1 | .84 | .32 | 31.4 |
| | PCPN: | .48 | .56 | .72 | 1.2 | 2.4 | 3.7 | 2.8 | 2.5 | 2.5 | 1.6 | .52 | .44 | 19.5 |
| Lubbock County; Lubbock | TEMP: °F | 39 | 43 | 50 | 60 | 69 | 77 | 79 | 77 | 70 | 61 | 49 | 41 | 60 |
| | PE: | .20 | .40 | 1.1 | 2.5 | 4.2 | 5.8 | 6.4 | 5.6 | 3.9 | 2.3 | .88 | .32 | 33.6 |
| | PCPN: | .36 | .40 | 1.0 | 1.1 | 2.6 | 3.2 | 2.8 | 2.2 | 2.5 | 1.9 | .64 | .48 | 19.4 |
| Ochiltree County; Perryton | TEMP: °F | 33 | 37 | 44 | 55 | 63 | 73 | 79 | 76 | 67 | 57 | 44 | 35 | 55 |
| | PE: | - | .16 | .71 | 2.0 | 2.0 | 5.2 | 6.3 | 5.5 | 3.5 | 2.0 | .60 | .01 | 29.6 |
| | PCPN: | .39 | .43 | 1.4 | 1.2 | 2.8 | 3.3 | 3.1 | 2.7 | 1.9 | 1.1 | 1.2 | .55 | 20.5 |
| Parmer County; Friona | TEMP: °F | 37 | 39 | 47 | 56 | 65 | 73 | 77 | 75 | 67 | 58 | 46 | 38 | 57 |
| | PE: | .16 | .28 | .94 | 2.1 | 3.7 | 5.1 | 5.9 | 5.2 | 3.5 | 2.0 | .79 | .24 | 30.0 |
| | PCPN: | .47 | .43 | .71 | .83 | 1.5 | 3.0 | 2.8 | 2.4 | 1.9 | 1.2 | .55 | .43 | 16.3 |
| Swisher County; Tulia | TEMP: °F | 38 | 40 | 42 | 57 | 66 | 74 | 78 | 76 | 68 | 58 | 46 | 39 | 57 |
| | PE: | .12 | .32 | .61 | 2.1 | 3.8 | 5.2 | 6.0 | 5.4 | 3.6 | 2.1 | .75 | .24 | 30.6 |
| | PCPN: | .40 | .47 | .94 | 1.1 | 2.0 | 4.0 | 2.5 | 2.2 | 2.4 | 1.7 | .71 | .55 | 19.0 |

a/ For 1957-1976.

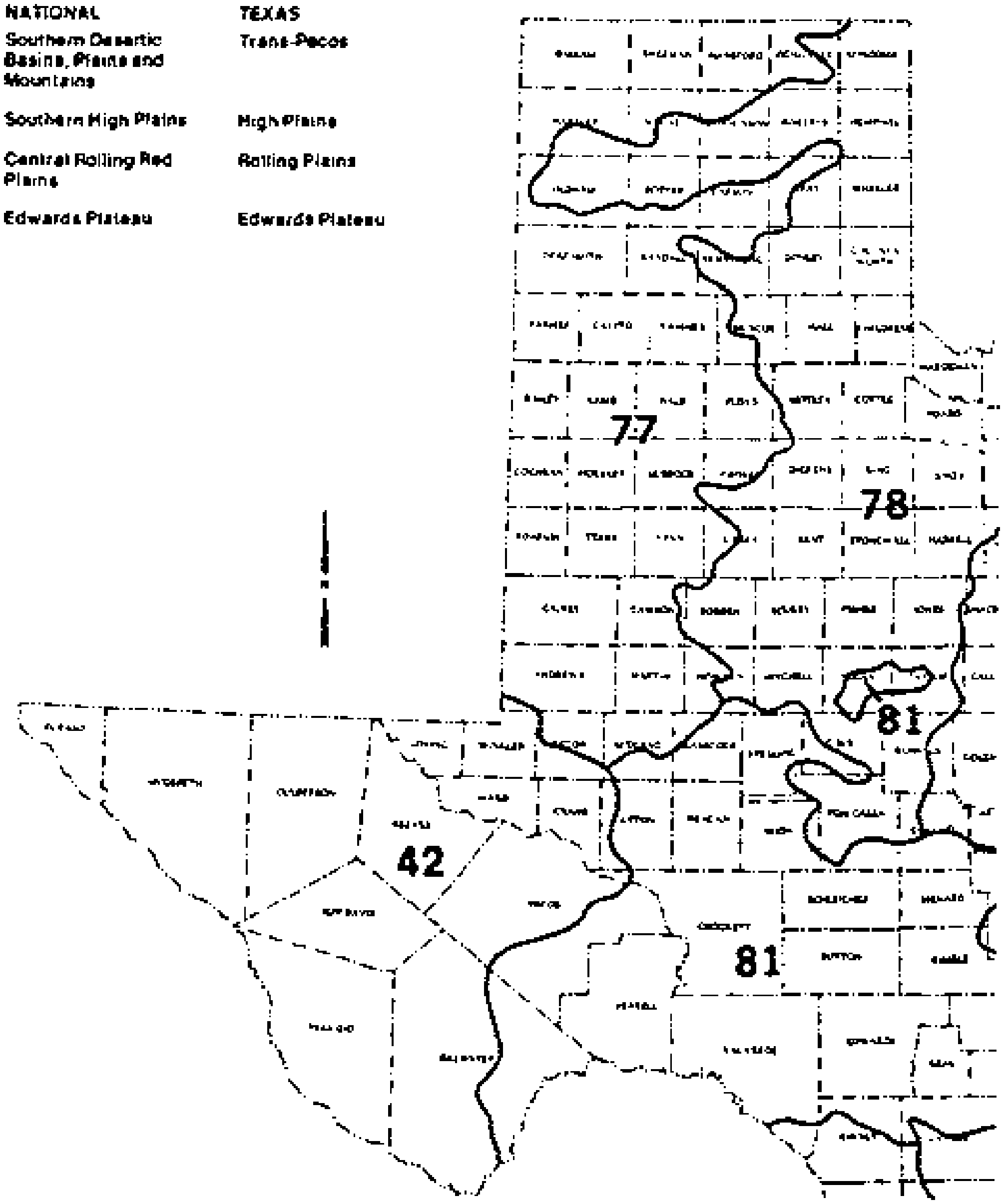
DISPLAY 3

# MAJOR LAND RESOURCE AREAS

## LEGEND

| | NATIONAL | TEXAS |
|---|---|---|
| 42 | Southern Desertic Basins, Plains and Mountains | Trans-Pecos |
| 77 | Southern High Plains | High Plains |
| 78 | Central Rolling Red Plains | Rolling Plains |
| 81 | Edwards Plateau | Edwards Plateau |

## TEXAS



# PROPERTY RECORD EXPLANATION

## Headings

Map Unit is for the specific soil survey area.

Permanent Practices gives the mechanical alterations in the land designed to reduce erosion, to increase productivity, or to improve the feasibility of a particular use. Commonly these practices are not included in the Hap Unit definition. Examples are terraces and windbreaks.

Calendar Year Use gives the crop and the major cultural or management practices that would influence the record for the calendar year of the record. Range site and pasture species are included as well as practices that pertain to cropland.

Rotation gives the cropping sequence or grazing schedule for the calendar year of record, and as a minimum for the calendar years immediately prior to and following the year of record.

Water Regime is the relative wetness or dryness of the plant growing portion of the year of the record. The period of irrigation is excluded. The classes wet, average. and dry are employed. Average pertains to the expected condition 6 years in 10. Dry pertains to 2 years in 10 on the dry side, and wet to 2 years in 10 on the wet side.

Location is usually a soil survey area that encompasses a county.

Record Number contains in the order listed the Major Land Resource Area. the state abbreviation, the county PIPS Number, and three digits which pertain to the chronological order of record completion within the Location.

Use Code designates the rotation, calendar year use. and important aspects of the operations schedule. It is designed for possible computer sorting of the information. Mo experience has been obtained with a code. To follow is a suggested approach.

The code would have six entries: Map Unit, Permanent Practices, crop and practice separately of Calendar Year Use. Rotation, and Water Regime. The Hap Unit is indicated by its numerical alphabetical order for the survey. The code for Permanent Practices is the same as is used to document SCS activities. The crop portion of the Calender Year Use comes from the list that follows to be expanded as required:

- CCR--corn for grain
- CSL--corn silage
- SCR--sorghum for grain
- SSL--sorghum silage
- COT--cotton
- PNT--peanuts
- SOY--soybean
- SUP--sunflowers

WBR--winter barley
WOT--winter oats
WWT--winter wheat
LHA--legume hay
NLH--non legume hay
PAL--fallow

The practice part of the Calender Year Use is drawn from a list of practices each identified with a two digit number. One or two practices may be given. If two practices are indicated, the two digit numbers are combined to form a four digit number. If only one practice is given. two trailing zeros are added to make a four digit entry. Rotation is designated with a three digit entry. A list of notations for the Texas portion of MLRA would be assembled. A letter code is used for the Water Regime: A--Average; D--Dry; W--Wet.

Operations Schedule gives in chronological order, beginning with the previous calendar year. the kind and the date of operations that would be expected to influence significantly entries in the record.

Date (backside) pertains to when the record was completed.

Compiled By (backside) gives the people with principal responsibility for completing the record.

## Columns

Line Number is the row position in the record.

Kind of Information is a short description of the entry.

Entry Numbers are alpha-numeric numbers assigned to each entry. The first three positions in the Entry Number are arabic numbers that indicate the kind of entry. The fourth position is a letter. It signifies the source of the information in a general sense. Information from the map unit record as adjusted if necessary for permanent modifications is not dependent on the calendar year use. and so is distinguished from use dependent values. Further separations are made within use dependent values dependent on the source of the information. The letter designations are defined as follows:

A. Prom the Map Unit Record with possible adjustments for Permanent Modifications; not use dependent.

B. Use dependent; based on experience and measurements for soil series and uses other than the one of concern, or for the same soil series and use in another soil survey area.

C. Use dependent; based on experience and measurements for the soil series and use of concern within the survey area of the record.

D. Use dependent; based on a computer based model.

## Entries

This section describes the soil properties listed in the Kind Of Entry column. The entry is described in a general sense first. This explanation may contain information on the application of the entry. The general explanation is followed by descriptions of specific kinds of entries. Reference materials are in the Appendix, including Soil Property Records for a J-year rotation. and blank copies of the forms employed. The numbers assigned to each entry are listed on the right hand side. The Entry Descriptions are in ascending order of entry number.

### Explanatory Notes:

Notes are employed in the entry descriptions to reduce repetition where there are two or more entries that require the same explanatory information. The Notes follow:

Note 001: WEQ refers to the Wind Erosion Equation, developed by the Agricultural Research Service. Manhattan, Kansas. The equation gives long term average rates of erosion.

Note 002: The Universal Soil Loss Equation (USLE) is a current model for water erosion. The model excludes erosion by larger rills and by gullies.

Note 003: Tillage Zone Thickness extends from the ground surface to the base of the deepest evidence of recurring mechanical disturbance by animals or by implements, exclusive of deep plowing for erosion control.

The Upper Tillage Zone extends from the ground surface to the base of mechanical disturbance by the most recent tillage operation, commonly 3 to 5 inches.

The Lower Tillage Zone extends from the base of the most recent mechanical disturbance to the base of the deepest recurring annual or near annual tillage. Thickness may vary from 1 inch to more than 4 inches. It commonly exhibits mechanical compaction and may be the limiting zone for infiltration.

Note 004: Bulk densities are for the moist soil, exclusive of rock fragments. Measurements may be by several methods, including gamma probe, clod, core, and excavation.

Note 005: The Erosion Productivity Impact Calculator (EPIC) is a process model that integrates a weather generator with hydrology, soils and plant growth to project crop yields and soil loss due to erosion. The model operates on a daily time step and is also designed for running many years to approximate the affects of weather variations and the long term effects due to erosion. It is presently operated at the Grassland Soil and Water Research Laboratory, Temple, Texas.

Rote 006: The entries Effective Hydrologic croup, Antecedent Moisture Condition, Hydrologic Soil Cover Complexes pertain to the estimation of runoff potential using the entry. Runoff Curve Number. The procedure for runoff prediction is referred to as the Curve Number method. A family of curves that relate the daily runoff and the daily precipitation have been generated. Each of the curves has been assigned a number. The curve that, is selected depends on the Hydrologic Soil Croup. which is a relative ranking of the water intake for the soil under clean tilled conditions and after thorough wetting; on the water state or relative wetness and dryness assumed; and on the ground surface cover. tillage practice and the like. The approach is explained in Chapter 4 of the National Engineering Handbook, Soil Conservation Service.

Note 007: Root depths are the distance from the ground surface to the specified position. Root depth estimates involve generalizations from differing amounts of field observations. In all instances, at least some field information is available. In some instances, considerable field information can be applied. It is assumed that root proliferation only occurs if the water state is wetter than Slightly Dry (DS). Plant extraction, however. may occur in the Slightly Dry state if rooting occurred while the water state was wetter. Water state is given in the 016 entries. Rooting characteristics are addressed in Section 15. "Irrigation." of the National Engineering Handbook, Chapter 1, "Soil-Plant-Water Relationships."

Note 008: The soil has been subdivided into major horizons. The maximum depth is determined by the base of maximum potential rooting at physiological maturity if water is not limiting, or by a root restricting layer.

Note 009: The set of water state classes follows. Three major classes of water state are recognized--Dry, Moist, and Wet. Dry and Hoist are separated at 15 bar. Wet is separated from Hoist at 0.01 bar. Three subclasses of Dry are distinguished--V- Dry, Hoderately Dry, and Slightly Dry. The separation between Very Dry and Moderately Dry is at 50 percent relative more than the air dry moisture, which is approximated as 0.35 times the retention at 15 bar. Very Dry soil material should be subject to wind erosion if otherwise conditions are favorable. Moderately Dry is separated from Slightly Dry at a water content equal to 0.8 times 15 bar retention. Drought resistant crops such as grain sorghum reduce soil water to below 15 bar retention. For such crops. the limit between Hoderately Dry and Slightly Dry may be a reasonable estimate for the minimum water content.

Hoist is divided into three subclasses--Slightly Hoist. Hoderately Hoist, and Very Hoist. Slightly Hoist is the lower half of the available water range and Hoderately Moist is the upper half of the range. The separation is whet-e irrigation is commonly initiated. The upper limit of Hoderately Hoist. referred to as the Upper Water Retention, is the water retention at 0.05. 0.1 or 1/3 bar. depending on whether the soil material is very coarse, moderately coarse, or finer than moderately coarse. Slightly Moist is separated from Hoderately Moist at the Midpoint Water Retention Difference which is half the difference between the Upper Water Retention and 15 bar retention or 0.8 x 15 bar retention, depending on the crop.

Very noist is the range from the Upper Water Retention to where the soil material is Wet.

Wet refers to soil material in which water films on sand grains and on macroscopic structural surfaces are quite apparent. The soil material glistens. A separation within Wet is made on whether free water is present. Satiation refers to the presence of free water, which encompasses the range from the first appearance of free water to saturation.

| Class Name | Symbol | Criteria |
|---|---|---|
| Dry | D | >15 bar |
| Very Dry | DV | <(.35 x 15 bar retention) |
| Moderately Dry | DM | >(.35 x 15 bar retention) to (.8 x 15 bar retention) |
| slightly Dry | DS | >(.8 x 15 bar retention) to 15 bar |
| Moist | M | 15 to .01 or 0.005 bar |
| slightly Moist | MS | 15 bar to Midpoint Water Retention Difference (MWRD) |
| Moderately Moist | MM | MWRD to Upper Water Retention (UWR) |
| Very Moist | MV | UWR to .01 or .005 bar |
| Wet | W | <.01 bar or <.005 bar |
| Not Satiated | WN | No free water |
| Satiated | WA | Free water present |

Surface Crust-Resistance/Thickness: 001

Surface crust refers to the modification of the uppermost part of the soil hy raindrop impact, freeze-thaw, and local transport and deposition to produce an organization that is more restrictive to low suction and free water movement than immediately beneath. and which may offer greater mechanical resistance to seedling emergence. Crust expression pertains to water state estimation, Final Infiltration Rate, and Effective Hydrologic Croup.

001B,C01

The crust is removed and air dried. Specimens are 1/2 inch on edge and 1/4 inch thick, or the thickness of the crust if less than 1/4 inch. The thickness includes the crust proper and any adhering soil material. Specimens are held on edge and crushed between thumb and forefinger. Classes are in the table to follow. A top loading balance, such as is used for weighing mail, may he used to measure the crust rupture resistance. A bar 1/4 inch wide is placed on the scale. The specimen is crushed with the forefinger and thumb of one hand while simultaneously applying the same felt pressure to the scale with the forefinger of the other hand. The scale is read upon rupture of the crust specimen.

| Class Name | Rupture Resistance lbs |
|---|---|
| Absent (A) | |
| Extremely Weak (EW) | Present but not removable |
| Very Weak (VW) | Removable; < 1/4 lb |
| Weak (W) | 1/4 - 3/4 |
| Moderate (M) | 3/4 - 2 |
| Strong (S) | 2 - 4 |
| Very Strong (VS) | 4 - 10 |
| Extremely Strong (ES) | $\geq$ 10 |

Upper Tillage Zone Thickness: 002

Note 003.

002B,C01

Based on observations, experience. and measurements.

002001

Note 005. Prom EPIC Model.

<u>Upper Tillage Zone Density</u>: 003

Notes 003. 004. Bulk densities are predictive of the final infiltration rate. resistance to water erosion. low suction water retention, and the general condition of the seedbed(tilth).

003B, co1

Based on observations. experience. and measurements.

003D01

Note 005. From EPIC Model.

<u>Lower Tillage Zone Thickness</u>: 004

Note 003.

004B,C01

Based on observations, experience and measurements.

004D01

Note 005. From EPIC Model.

<u>Lower Tillane Zone Density</u>: 005

Notes 003. 004. These bulk densities are predictive of root penetration and final infiltration rate.

005B,C01

Based on observations, experience and measurements.

005D01

Note 005. Prom EPIC Model.

<u>Upper Subsoil Density</u>: 006

Note 004. The Upper Subsoil is the layer immediately beneath the tillage zone. It may be subject to mechanical compaction. IF the overlying Lower Tillage Zone is not compacted, this layer may be the limiting zone for infiltration. Thickness is not specified but generally is less than 6 inches. These bulk densities may affect root penetration and in some instances the final infiltration rate.

006B,C01

Based on observations, experience and measurements.

Final Infiltration Rate: 007
This is the rate of downward movement of water after prolonged surface ponding. Usually the rate is constant. or the decrease with time is quite small. The Final Infiltration Rate is used to calculate the Design Intake Family. the Expected Net Intake, the Effective Hydrologic Group, and is employed in the computation of field water status.

007A01

This is based on the permeability of the most restrictive layer within 40 inches of the soil surface. Values are obtained from the Soil Interpretation Record for the soil series.

007B,C01

This is the steady ponded infiltration rate measured with a constant-head. recording, double ring infiltrometer. A lo-inch-diameter ring is seated in the most restrictive part of the upper horizons. The crust is removed. A constant head of 1.5 inches is maintained and infiltration is recorded by water level recorders. The rate is reported after ponding for 24 hours or longer. Crust expression and bulk densities of the tillage subzones and of the upper subsoil are recorded. Display A7 was developed from data obtained by this method.

007B,C02

The same as 007B,C01 except that the crust is present.

Design Intake Family: 008
The Design Intake Family is employed to design irrigation systems. They are based on generalized relationships between cumulative intake rate and time. The numerical values given are an estimate of the final intake rate. These estimates have limitations as indicated by the following quote taken from Chapter 5 of the National Engineering Handbook: 'There is no simple guideline, such as soil texture, to govern placement of a soil in a specific group. If field experience is inadequate to group the soils properly, field evaluation should be made."

008A01

Prom the Soil Survey Interpretation Record and from irrigation guides for the Major Land Resource Area.

008B,C01

Data collected with a constant-head, recording, double ring infiltrometer. (007B,C01). The curve obtained is compared to those in Fig. l-10 of Section 15 of the National Engineering Handbook to determine the Design Intake Family. If the curve crosses several intake family curves, it is considered nontypical, and the designation not NT is entered.

008B,C02

Data obtained with flowing infiltrometers; otherwise follows 008B,C01.

Expected Net Furrow Intake: 009

The Expected Net Furrow Intake is used to plan irrigation schedules. It is the net amount of water that can enter the soil for the dominant set time employed. A curve is used that relates the Expected Net Intake and the bulk density of the Lower Tillage Zone and upper Subsoil.

009A01

Prom the Soil Survey Interpretation Record and from MLRA irrigation guides.

009B,C01

Derived from data obtained with a constant-head, recording, double ring infiltrometer (Entry 007B,C01).

009B,C02

Data obtained with a flowing infiltrometer.

Effective Hydrologic Croup: 010

Note 006. The Hydrologic Group is an estimate of steady ponded infiltration rate for bare soil under wet condition.

010A01

The soil series Hydrologic Group from soil survey interpretation records

010B,C01

Based on Final Infiltration Rates derived from infiltrometer data using the guidelines to follow:

| Final Infiltration Rate in/hr | Effective Hydrologic Group |
|---|---|
| < .1 | D |
| .1 to .3 | C |
| .3 to .5 | B |
| ≥ .5 | A |

These guidelines only apply if the soil is moderately deep or deep and free water does not occur above 20 inches. If these conditions are not met. the Hydrologic Group for the soil series is employed and the Final Infiltration Rate is not considered.

Much Final Infiltration Rate data are for the uncrusted condition (007B,C01). An adjustment for crust is advisable. For soil series Hydrologic Croup A or D, it is assumed that crust expression has little influence on runoff. Hence. the Final Infiltration Rate measurements for the uncrusted condition at-e used without adjustment. For soils that are in soil series Hydrologic Group B or in C with loam or finer textured near surfaces, the Final Infiltration Rates for the uncrusted condition are adjusted using the following guidelines:

Hydrologic Croup C--Reduce the measured Final Infiltration Rate by one-fourth if the crust is Weak and by one-half if more pronounced than Weak. If the expression is less than Weak. ignore the crust.

Hydrologic Croup B--Reduce the measured Final Infiltration Rate by one-fourth if the crust is Moderate or stronger. If the expression is less than Moderate, ignore the crust.

Antecedent Moisture Condition: 011

Note 006. Antecedent Moisture Condition is an index of soil wetness based on the accumulated 5-day antecedent rainfall. It is used in the estimation of the Runoff Curve Number. Three antecedent conditions are defined: I--Dry; II--hoist; III--Wet.

011B,C01

Note 009. The monthly water state (016 entries) is employed. The guidelines to follow at-e from Texas Engineering Note, Hydrology 210-18-TX5.

I--Dry (D) O-10 inches; or Slightly Hoist (MS) O-10 inches and Slightly Hoist or Dry 10-20 inches.

III--Wet (W) O-10 inches; or Very Moist (MV) O-10 inches, and Very Moist or wetter 10-20 inches.

II--Other

011D01

Note 005. From the EPIC Model.

Hydrologic Soil Cover Complexes: 012

Note 006. This factor reduces the runoff from the bare condition dependent on the condition of the ground surface as part of the determination of the Runoff Curve Number.

012B,C01

The first letter denotes the soil use, the second the conservation practices employed, the third the amount of residue. and the fourth the percent crop canopy. The entry codes are as follows:

| Position | Letter | Specification |
|---|---|---|
| 1 | F | Fallow |
| 1 | R | Row crops |
| 1 | S | Small grain |
| 1 | C | Close seeded legumes, meadow |
| 1 | P | Pasture or Range |
| 1 | W | Woods |
| 2 | T | Straight Row |
| 2 | 0 | Contoured, not terraced |
| 2 | E | Contoured, terraced |
| 3 | B | Not specified |
| 3 | P | Poor |
| 3 | G | Good |
| 4 | P | Poor |
| 4 | G | Good |
| 4 | B | Not specified |

012D01

Note 005. Prom the EPIC Model.

Runoff Curve Number: 013

Note 006. This number indicates the expected relationship between daily precipitation and daily runoff. It is based on entries 010-012.

013B,C01

This is calculated using 010-012 entries.

013D01

Note 005. Prom RPIC Model.

Rooting Depths. Common: 014

Note 007. Distance to the maximum depth of common alive roots. For tap rooted plants, the deepest rooting depth is employed.

014B,C01

Based on observations, experience and measurements.

014D01

Note 005. Prom EPIC Model.

Rooting Depths, Pew: 015

Note 007. Distance to the maximum depth of few alive roots. Does not apply to tap rooted plants.

015B,C01

Based on observations, experience and measurements.

015D01

Note 005. From EPIC Model.

AWC; Percent of AWC/State 016

Note 009. This entry gives both the available water capacity (AWC) as computed from laboratory water retention difference plus a description of the actual field water state over time. The field water state is expressed both as a percentage of the available water capacity and as water state class. The depths pertain to major soil horizons down to the base of maximum rooting at physiological maturity or to a root restricting layer.

016A01

The values come from laboratory water retention differences. The lower limit of available water is taken as 0.8 x the 15-bar retention for stress resistant crops and 15-bar for other crops. Stress resistant crops include cotton, grain sorghum, and wheat. Corn is a stress sensitive crop.

A procedure follows which is applicable to a wide range of soils in PE zones 24 through 34 of

Display A16-2 has 3 categories of surface residue expressed as flat small grain equivalent (Entry 0257: (1) High Residue--more than 2600 lbs/acre, (2) Moderate residue--1000-2600 lbs/acre, and (3) Low residue--less than 1000 lbs/acre and commonly about 500 lbs. Some clean-tilled crops are in the Low category because of the orientation of crop stubble and lack of canopy. As residues deteriorate, or are destroyed by tillage, the applicable monthly residue class may change. Choose the applicable category for each month based on anticipated residues (which can be estimated fairly closely using the Texas Erosion Handbook) and type of tillage operation performed. The quantities shown by month in Display A16-2 list both a percentage of the tillage zone Available Water Capacity (AWC), and the amount in inches. These values are based on a total AWC of the entire surface layer or tillage zone. The values assume that no tillage is performed during the month.

The lower part of Display A16-2 is a guide for computation of estimations of water losses due to various tillage operations during the month. Tillage operations are shown on the left. The assumed percentage loss of the AWC is in the center. The right hand column gives the water loss in inches for the particular AWC assumed. The loss is assumed to occur rapidly so the time of the month is not a consideration.

Here is an example: Enter Way with 3600 lbs of flat small grain equivalent residue and perform a disk operation on the 20th of the month. What is the evaporation value for the month?

Ray--3600 lbs = 0.93 inches loss

Disk Tillage = 0.53 additional loss

1.46 inches total loss

This value is then entered for the month of May on the EvapoTranspiration line in Display A16-1.

Net Infiltration: Display A16-3 shows the cumulative infiltration for 1. 2. and 3 hours for the Pullman series in Armstrong, Carson, Gray, and Randall Counties. Infiltration rate is based on the method described in 007B,C01. Similar figures would be developed for other major soil series.

Cumulative infiltration curves are stratified using the Lower Tillage Zone bulk density. The curve for Lower Tillage Zone bulk densities of less than 1.45 g/cc assume conservation tillage with considerable residue on the soil surface. Clean tillage systems lead to lower amounts of residue, higher bulk densities, and lower infiltration rates.

To make the computation, enter on the right hand side of Display A16-3 the appropriate bulk density listed in the field water status worksheet. Then follow the applicable curves to the 1, 2, or 3 hour opportunity time. The selection of the opportunity time will be discussed. Interpolate between curves if needed and read net infiltration in inches from the left.

An analysis of National Weather Service climate data for months with rainfall in excess of 2 inches per month coupled with field experience suggests that on the average free water occurs on the soil surface for 2 hours in a month. For months in which average precipitation is less than allowable net infiltration from Display A16-3, it is assumed that no runof f occurs. For MLRA 77. this is generally applicable from May through September. To follow are guidelines for opportunity time:

For small grain. during the period immediately after tillering (about March 15) through harvest and the fallow period, if the residues equal or exceed 2000 lbs of small grain equivalent. the opportunity time is increased to 3 hours. This increase is due to the combination of increased plant demand for water and the physical retardance to overland flow.

For clean-tilled crops an adjustment in opportunity time is needed to reflect the condition of the surface and subsurface as well as the common presence of furrows which enhance runoff. If surface texture is loam or finer, and a surface crust is present that is weak or stronger, the opportunity time is reduced to 1 hour.

Furrow dikes increase the opportunity time for clean-tilled crops. If furrow dikes are installed in alternate furrows. increase the value from Display A16-3 by 40 percent. If all furrows are diked. increase the value by 75 percent.

For continuous wheat using a conventional disk-tillage system with less than 2000 lbs small grain equivalent residue, use a 2-hour opportunity time to calculate a net infiltration. Then reduce for various thicknesses of surface crust by the percentages to follow:

| Thickness inches | Reduction percent |
|---|---|
| 1132 | 10 |
| 2/32 | 20 |
| 3/32 | 35 |
| 4/32 | 40 |
| 5/32 | 60 |

The following is an example of the computation:

crop : Winter-Wheat. Disk Tillage
Average May Rainfall: 3.6 inches
Surface Crust: Weak-2132 inch thick W-27
Lower Tillage Zone Bulk Density: 1.55 g/cc

Ret infiltration from Display A16-3 for a 2-hour opportunity time is 1.70 inches. This is reduced by 20 percent for the presence of crust. The entry is 1.36 inches on the field water status worksheet for the net infiltration in May.

Irrigation: To obtain net sprinkler irrigation, use sprinkler evaluation summaries available in field offices. These summaries indicate the gross applications and the percentage efficiencies from which the net can be calculated. The net is entered on the field water status worksheet under the applicable monthly column. For furrow or other surface systems, the value for Expected Net Intake from Display A7-1 constitute the net application of irrigation water for each irrigation event.

Soil Woisture Difference: The Soil Woisture Difference is computed by subtracting monthly Evapotranspiration values from net infiltration (plus net irrigation). The result may be either a net gain or a net loss for the month.

Monthly Water Balance: The Wonthly Water Balance is the amount of water in inches remaining in the soil at the end of the month. It is computed by adding the soil water difference for the month to the monthly water balance of the the preceding month. These values are entered in the Soil Properties Record for the applicable month on the line that gives the Percent of Available Water present.

These computations should be initiated when soil moisture is highest or lowest. These two conditions usually occur following prolonged rainfall after a preplant irrigation, or after harvest. The most accurate estimate for the area is probably immediately after harvest. Soil moisture is commonly the lowest and the soil is dried uniformly. Computations are continued for successive months following the initial month through the 1. 2. or 3 year rotation cycle.

The first step in obtaining a reasonable water distribution pattern with depth is to divide the monthly water balance by the total available water capacity of the soil. This gives the average percent available water content for the entire depth considered. The total available water content for the depth considered is then distributed. The distribution involves judgment and past observations of moisture distribution and a knowledge of plant extraction patterns. Increases by depth interval should simulate a wetting front as water percolates through the soil. The content of an underlying layer is increased only after the available moisture as a percent of the total in the overlying layer exceeds 50 percent, and approaches 75 percent. Soil series would differ from each other in this respect.

The following is an illustration of how the water status is adjusted. The example is for the wheat hat-vest year of Pullman clay loam, Carson County, Texas. The starting point is 1.64 inches in June after wheat harvest, and the soil moisture difference for the following month is +1.95 inches. The values in the example are carried to one more significant figure that should be reported in order to permit checking of the computation. The water content in excess of 75 percent of the percent of field capacity for the uppermost layer is shunted to the layer beneath. When the second layer reaches 75 percent of the available water capacity, water is shunted to the third layer, and so forth.

June

Available Water Deficit: 019

Note 008. It is the inches of water that would be reauired to bring the soil to field capacity. It is calculated from the difference between total Available Water Capacity and the total Available Water Present.

019B,C01

Computed using 018B,C01.

019D01

Computed using 018D01.

Anticipated Yields: 020

Yields are calculated on the assumption that soil water is limiting. Information on the water status from entries 016-019 is employed. Locally applicable relationships are commonly used. These relationships are available from state and federal research groups. Yield estimates from EPIC or other computer based models may be used.

020B,C01

Equations to follow are for use in the northern half of MLRA 77. Total water use values from planting to harvest for summer crops are obtained from Display A16-1. For cool season crops water use is from boot stage to harvest only. The quantity is obtained by summing the monthly evapotranspiration from the month of planting to harvest.

Grain Sorghum:

Inches total water use from table A16-1 - 6.0 inches to boot stage x 300 to 350 lbs/inch water use = lbs/acre

Wheat:

Inches water use from boot to maturity from table A16-1 x 5 to 6 bu/inch water use = bu/acre

Cotton:

Inches water use from table A16-1 - 8.0 inches(5.0, dryland) for stalk x 50 lbs/inch water use = lbs lint/acre

020D01

Note 005. Prom EPIC Model.

**WEQ I:** 021

**Note** 001. The potential annual soil loss assumed to occur at Garden City, Kansas. for a wide, unsheltered field that is bare and **uncrusted.** It is based on the percent **aggregates >** 0.84 mm (No. 35 sieve) in the surface layer.

0211101

Follows guidelines in the Texas Erosion Handbook. These guidelines are based on texture and carbonate content of surface horizons.

**021B,C01**

Based on sieving measurements by the Agriculture Research Service station, **Big** Spring. Texas. as interpreted using the Texas Erosion Handbook.

**WEQ K:** 022

Note 001. Soil ridge **roughness** factor. Pertains to the resistance to wind erosion due to ridges of different heights and spacings.

**022B,C01**

Guidelines From Texas Erosion Handbook.

**WEQ C:** 023

Note 001. Determined by the average wind velocity and by surface soil moisture.

**023B,C01**

Guidelines from the Texas **Erosion** Handbook.

**WEQ L:** 024

Note 001. The unsheltered distance across the field for the prevailing or damaging wind direction.

**024B,C01**

**Guidelines** from the Texas Erosion Handbook.

WEQ V: 025

Note 001. Quantity, kind, and orientation of vegetation expressed as an equivalent quantity of flat small grain residue. The reference is the wind erosion of sand covered by various amounts of wheat straw in 10 inch lengths laid in rows parallel to the wind direction. Erosion for other residues as defined by kind, amount and configuration has been determined experimentally. The effectiveness of the other residues is expressed by the amount of flat small grain which gave the same wind erosion.

025B,C01

Guidelines from the Texas Erosion Handbook.

025D01

Prom EPIC Model.

WEQ Soil Loss: 026

Mote 001. Computed from the previously given factors.

026B,C01

Computation described in Texas Erosion Handbook.

026D01

Note 005. From EPIC Model.

USLE R: 027

Note 002. Dependent on rainfall intensity and amount which together establish the number of erosion index units.

027A01

Values are in the Texas Erosion Handbook.

USLE K: 028

Note 002. Brodibility factor. It is the soil loss rate per erosion index unit as measured on a unit plot, which has defined dimensions. a uniform g-percent slope and is in continuous clean-tilled fallow. The erosion index is calculated by summing the products of the total energy and the 30-minute intensity of storms for the year that meets certain criteria. Values are in the National Erosion Handbook.

028A01

Values are in the Texas Erosion Handbook.

<u>USLE L:</u> 029
Note 002. The length from the point of origin of runoff to sediment deposition, channel entry. or the edge of the field.

029A01
Values are in the Texas Erosion Handbook.

<u>USLE S:</u> 030
Note 002. The percent slope.

030A01
Prom map unit definition.

<u>USLE LS:</u> 031
Note 002. Combines slope length and slope gradient.

031A01
Values are in the Texas Erosion Handbook.

<u>USLE C:</u> 032
Note 002. The factor for the ground surface cover and the management.

032B,C01
Yearly values are in the Texas Erosion Handbook. Monthly values may be computed.

032D01
Note 005. Prom EPIC Model.

<u>USLE P:</u> 033
Note 002. The factor for erosion control practices.

033A01
Values are in the Texas Soil Erosion Handbook.

<u>USLE Soil Loss</u>: 034
Note 002. Computed soil loss based on multiplication of the previously given quantities.

034B,C01

Explanation in Texas Soil Erosion Handbook.

034D01

From the EPIC Model.

<u>Soil Condition Ratina Index. Overall</u>: 035
This is a rating system to record the relative effect of a specific resource managment system on physical. chemical, and biological condition of a soil and its ability to sustain production of crops. Plus and minus values are assigned and the algebraic sums determined for four aspects: Crop and Residue, Tillage, Mulch, and Erosion. The computation is so designed that as the resource management system improves, the sum will become more positive.

035B,C01

Guidelines in Texas Field Office Technical Guide (Draft).

<u>Soil Condition Ratina Index. Crop</u>: 036
This entry reflects the effect on the Soil Condition Rating index of the crops grown and the amounts of crop growth residue returned annually.

036B,C01

Guidelines in Texas Field Office Technical Guide (Draft).

<u>Soil Condition Rating Index, Tillage</u>: 037
This entry reflects the effect of primary tillage, secondary tillage and supplemental operations on soil physical properties for computation of the Soil Condition Rating Index.

037B,C01

Guidelines in Texas Field Office Technical Guide (Draft).

<u>Soil Condition Rating Index. Mulch</u>: 038

This entry reflects the effect of addition of cow, sheep. and poultry manure, gin trash. straw. and grass hay, for the computation of the Soil Condition Rating Index.

038B,C01

Guidelines in Texas Field Office Technical Guide (Draft).

<u>Soil Condition Rating Index. Erosion</u>: 039

This reflects the effect of annual soil loss as determined by USLE or WEQ (Notes 001. 002) relative to the assigned soil loss tolerance. The computation is part of the Soil Condition Rating Index.

039B,C01

Guidelines in Field Office Technical Guide (Draft).

APPENDIX

# FIELD WATER STATUS WORKSHEET

County: ____________________
Mapping Unit Name: ____________________
Cropping Sequence: ____________________

| KIND OF INFORMATION | DEPTH (INCHES) | UNITS | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | QUANTITIES ASSIGNED | | | | | | | | | | | |
| Tillage Operations | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Lower tillage zone density | | gm/cc | | | | | | | | | | | | |
| Crust Expression | | | | | | | | | | | | | | |
| Root Depth | | Inches | | | | | | | | | | | | |
| Evapotranspiration 1/ | | Inches | | | | | | | | | | | | |
| Precipitation (Net) 2/ | | Inches | | | | | | | | | | | | |
| Irrigation (Net) 3/ | | Inches | | | | | | | | | | | | |
| Soil Moisture Difference | | Inches | | | | | | | | | | | | |
| Monthly Water Balance 4/, 5/ | DEPTH (INCHES) | AWC Inches | | | | | | | | | | | | |
| Layer 1 | | | | | | | | | | | | | | |
| Layer 2 | | | | | | | | | | | | | | |
| Layer 3 | | | | | | | | | | | | | | |
| Layer 4 | | | | | | | | | | | | | | |
| Layer 5 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Deep Drainage Loss | | Inches | | | | | | | | | | | | |

1/ For fallow periods, use Display 16 - 2; For growing crops, refer to applicable evapo-transpiration curves.

2/ From Display A- 71 applicable Soil Series cumulative infiltration chart on conservation tillage, Or continuous small grain with conventional tillage to applicable percentage based on crust expression.

3/ From Display 16 - 3 applicable Soil Series Cumulative infiltration chart, or sprinkler evaluation summaries.

4/ End of Month Balance only. Enter in appropriate blank on Soil Properties Record.

5/ Do not show water increases in next lower layer.

# FIELD WATER STATUS WORKSHEET

County: Carson
Mapping Unit Name: Pullman Clay loam, PUA
Cropping Sequence: Wheat

| KIND OF INFORMATION | | UNITS | QUANTITIES ASSIGNED J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tillage Operations | | | Graze | | | | Irrigate | | Harvest Disk | Sweep | Graze | Volunteer | | |
| Lower tillage zone density | | W/CC | 1.35 | 1.35 | 1.40 | 1.40 | 1.40 | 1.40 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 |
| Crust Expression | | | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| Root Depth | | Inches | 40 | 48 | 60 | 70 | 70 | 70 | | | 6 | 20 | 20 | 20 |
| Evapotranspiration 1/ | | Inches | 1.24 | 1.40 | 2.17 | 4.50 | 7.75 | 4.24 | 1.72 | 1.33 | 1.06 | 0.9 | 1.15 | .85 |
| Precipitation (Net) 2/ | | Inches | .5 | .7 | 1.0 | 1.0 | 2.50 | 2.50 | 1.80 | 1.80 | 1.60 | 1.30 | .6 | .6 |
| Irrigation (Net) 3/ | | Inches | | | | | 5.00 | | | | | | | |
| Soil Moisture Difference | | Inches | -.74 | -.7 | -1.17 | -3.5 | +.75 | -1.74 | +.08 | +.47 | +.54 | +.40 | -.55 | -.25 |
| Monthly Water Balance 4/, 5/ DEPTH (INCHES) | | AWC Inches 9.7 | 8.96 | 8.26 | 7.09 | 3.59 | 4.34 | 2.6 | 2.68 | 3.15 | 3.69 | 4.09 | 3.54 | 3.28 |
| Layer 1 | | | 30 | 30 | 25 | 25 | 60 | 25 | 31 | 65 | 66 | 70 | 40 | 30 |
| Layer 2 | | | 51 | 41 | 30 | 25 | 35 | 20 | 20 | 20 | 39 | 51 | 46 | 42 |
| Layer 3 | | | 84 | 74 | 64 | 25 | 25 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Layer 4 | | | 74 | 74 | 66 | 31 | 31 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Layer 5 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Deep Drainage Loss | | Inches | | | | | | | | | | | | |

1/ For fallow periods, use Display 16 - 2; For growing crops, refer to applicable evapo-transpiration curves.
2/ From Display A - 71 applicable Soil Series cumulative infiltration chart. on conservation tillage, or continuous small grain with conventional tillage to applicable percentage based on crust expression.
3/ From Display 16 - 3 applicable Soil Series Cumulative infiltration chart. or sprinkler evaluation summaries.
4/ End of Month Balance only. Enter in appropriate blank on Soil Properties Record.
5/ Do not show water increases in next lower layer until upper layer exceeds 50% and approaches 75%.

*Note applicable to Display 1*

Display 16-1

FALLOW PERIOD EVAPORATION 1/, 2/

__________ and __________ Counties

______________ Soil Series

| Residue Mgmt Sys. | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TILLAGE ZONE WATER LOSSES 3/ | | | | | | | | | | | |
| High residues < 2600 lbs | AWC. Pct. | 10% | 10% | % | % | % | % | 10% | 10% | % | % | % | % |
| | in. | | | | | | | | | | | | |
| Moderate residues 1000-2600 lbs | AWC. Pct. | % | % | % | % | % | % | % | % | % | % | % | % |
| | in. | | | | | | | | | | | | |
| Clean tillage and Low residues >1000 lbs | AWC. Pct. | % | % | % | % | % | % | % | % | % | % | % | % |
| | in. | | | | | | | | | | | | |

Percent Increase In Water Loss Due To Tillage 3/

| TILLAGE OPPERATION | PERCENT AWC. | INCHES |
|---|---|---|
| Disk (tandem or offset) | | |
| Sweep (Blade plow. 6-8" depth) | | |
| Sweeo (cultivator. 3 ?ÿÀ cüÀÀàÀ | ð þ ÿ€ 9 pÀ | 0 1 18 ÿ€ 9 1.582TT1 9.84 Tf -0.0177 T•s0 Tr 1 0 |
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| | | |

FALLOW PERIOD EVAPORATION 1/, 2/

CARSON and GRAY Counties

Pullman, Soil Series

| Residue Mgmt Sys. | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TILLAGE ZONE WATER LOSSES 3/ | | | | | | | | | | | |
| High residues < 2600 lbs | AWC. Pct. | 25% | 30% | 50% | 70% | 70% | 80% | 80% | 80% | 70% | 50% | 304 | 25% |
| | in. | 0.33 | 0.40 | 0.66 | 0.93 | 0.93 | 1.06 | 1.06 | 1.06 | 0.93 | 0.66 | 0.40 | 0.33 |
| Moderate residues 1000-2600 lbs | Pct. | 30% | 40% | 60% | 80% | 80% | 90% | 90% | 90% | 80% | 60% | 40% | 30% |
| | in. | 0.40 | 0.53 | 0.80 | 1.06 | 1.06 | 1.20 | 1.20 | 1.20 | 1.06 | 0.80 | 0.53 | 0.40 |
| Clean tillage and Low residues > 1000 lbs | AWC. Pct. | 35% | 45% | 65% | 85% | 85% | 95% | 95% | 95% | 85% | 65% | 45% | 35% |
| | in. | 0.97 | 0.60 | 0.86 | 1.13 | 1.13 | 1.26 | 1.26 | 1.26 | 1.13 | 0.86 | 0.60 | 0.47 |

Percent Increase In Water Loss Due To Tillage 3/

| TILLAGE OPPERATION | PERCENT AWC. | INCHES |
|---|---|---|
| Disk (tandem or offset) | 40 | 0.53 |
| Sweep (Blade plow, 6-8" depth) | 5 | 0.07 |
| Sweep (cultivator, 4" depth) | 10 | 0.13 |
| List | 40 | 0.53 |
| Chisel | 20 | 0.27 |
| Drill (no-till) | | |
| Drill (other) | 5 | 0.07 |
| Plant (no-till) | | |
| Plant (other) | 15 | 0.20 |

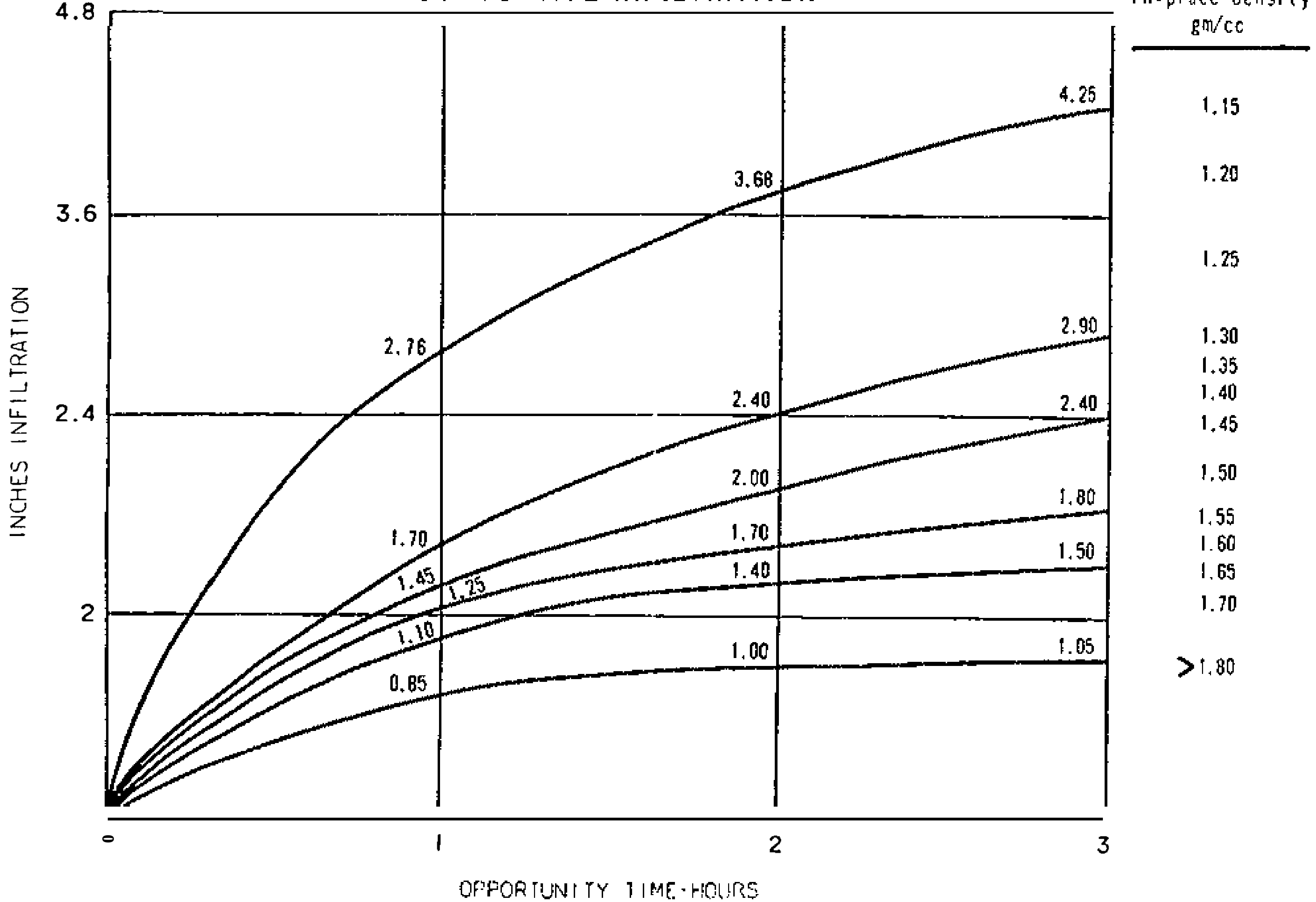
1/ Monthly water losses from the tillage zone. Quantities assigned are based on the available water holding capacity of the entire layer (1.33 Inches). These values are expressed as both percent AWC and inches of actual loss.

2/ Total water loss recorded as evaporation on the available water worksheet cannot exceed stored moisture in the tillage zone from the preceeding month plus monthly net precipitation.

3/ Values listed do not include losses due to tillage. These losses may be added to monthly values where appropriate.

Display 16-2

## PULLMAN SERIES
## CUMULATIVE INFILTRATION




DISPLAY 16-3

HAP UNIT
PERMANENT PRACTICES
CALENDER YEAR USE
ROTATION
WATER REGIME

# SOIL PROPERTIES RECORD

LOCATION
RECORD NO,
USE COOE

OPERATION SCHEDULE

| J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAP UNIT DERIVED | USE DEPENDENT | | | | | | | | | | | | |
| | | | | | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
| | Surface Crust - Resistance/Thickness | | 1/32 in. | | | | | | | | | | | | | | |
| 2 | Upper Tillage Zone-Thickness | | Inches | | | | | | | | | | | | | | |
| 3 | Upper Tillage Zone-Density | | gm/cc | | | | | | | | | | | | | | |
| 4 | Lower Tillage Zone-Thickness | | Inches | | | | | | | | | | | | | | |
| 5 | Lower Tillage Zone-Density | | gm/cc | | | | | | | | | | | | | | |
| 6 | Upper Subsoil-Density | | gm/cc | | | | | | | | | | | | | | |
| 7 | Final Infiltration Rate | | in/hr | | | | | | | | | | | | | | |
| 8 | Design Intake Family | | | | | | | | | | | | | | | | |
| 9 | Expected Wet Furrow Intake (__hrs) | | Inches | | | | | | | | | | | | | | |
| 10 | Effective Hydrologic Group | | | | | | | | | | | | | | | | |
| 11 | Antecedent Moisture Condition | | | | | | | | | | | | | | | | |
| 12 | Hydrologic Soil Cover Complexes | | | | | | | | | | | | | | | | |
| 13 | Runoff Curve Number | | | | | | | | | | | | | | | | |
| 14 | Depth Common Roots(or Tap Root) | | Inches | | | | | | | | | | | | | | |
| 15 | Depth Few Roots | | Inches | | | | | | | | | | | | | | |
| 16 | AWC: Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 17 | AWC: Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 18 | AWC: Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 19 | AWC: Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 20 | Total Avail. Water Capacity | | Inches | | | | | | | | | | | | | | |
| 21 | Avail. Water Present | | Inches | | | | | | | | | | | | | | |
| 22 | Avail. Water Deficit | | Inches | | | | | | | | | | | | | | |
| 23 | Anticipated Yields | | | | | | | | | | | | | | | | |

See display 1

| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAP UNIT DERIVED | USE DEPENDENT | | | | | | | | | | | | | |
| | | | | | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
| 24 | WEQ I | | T/Ac/Y | | | | | | | | | | | | | | |
| 25 | WEQ K | | | | | | | | | | | | | | | | |
| 26 | WEQ C | | | | | | | | | | | | | | | | |
| 27 | WEQ L | | Ft | | | | | | | | | | | | | | |
| 28 | WEQ V (SGe) | | Lbs/Ac | | | | | | | | | | | | | | |
| 29 | WEQ Soil Loss | | T/Ac/Y | | | | | | | | | | | | | | |
| 30 | USLE R | | | | | | | | | | | | | | | | |
| 31 | USLE K | | | | | | | | | | | | | | | | |
| 32 | USLE L | | Ft. | | | | | | | | | | | | | | |
| 33 | USLE S | | Pct. | | | | | | | | | | | | | | |
| 34 | USLE LS | | | | | | | | | | | | | | | | |
| 35 | USLE C | | | | | | | | | | | | | | | | |
| 36 | USLE P | | | | | | | | | | | | | | | | |
| 37 | USLE Soil Loss | | T/Ac/Y | | | | | | | | | | | | | | |
| 38 | Soil Condition Rating Index, Overall | | | | | | | | | | | | | | | | |
| 39 | Soil Condition Rating Index, Crop | | | | | | | | | | | | | | | | |
| 40 | Soil Condition Rating Index, Tillage | | | | | | | | | | | | | | | | |
| 41 | Soil Condition Rating Index, Mulch | | | | | | | | | | | | | | | | |
| 42 | Soil Condition Rating Index, Erosion | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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DATE
COMPILED

MAP UNIT
PERMANENT PRACTICE
CALENDER YEAR USE
ROTATION
WATER REGIME

# SOIL PROPERTIES RECORD

LOCATION
RECORD NO.
USE CODE

OPERATION SCHEDULE

J F A M J J A S O N D

| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAP UNIT DERIVED | USE DEPENDENT | | | | | | | | | | | | |
| | | | | | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
| | Surface Crust - Resistance/Thickness | | 1/32 in. | | | | | | | | | | | | | | |
| 2 | Upper Tillage Zone-Thickness | | Inches | | | | | | | | | | | | | | |
| 3 | Upper Tillage Zone-Density | | gm/cc | | | | | | | | | | | | | | |
| 4 | Lower Tillage Zone-Thickness | | Inches | | | | | | | | | | | | | | |
| 5 | Lower Tillage Zone-Density | | gm/cc | | | | | | | | | | | | | | |
| 6 | Upper Subsoil-Density | | gm/cc | | | | | | | | | | | | | | |
| 7 | Final Infiltration Rate | | in/hr | | | | | | | | | | | | | | |
| 8 | Design Intake Family | | | | | | | | | | | | | | | | |
| 9 | Expected Wet Furrow Intake (__ hrs) | | Inches | | | | | | | | | | | | | | |
| 10 | Effective Hydrologic Group | | | | | | | | | | | | | | | | |
| 11 | Antecedent Moisture Condition | | | | | | | | | | | | | | | | |
| 12 | Hydrologic Soil Cover Complexes | | | | | | | | | | | | | | | | |
| 13 | Runoff Curve Number | | | | | | | | | | | | | | | | |
| 14 | Depth Common Roots(or Tap Root) | | Inches | | | | | | | | | | | | | | |
| 15 | Depth Few Roots | | Inches | | | | | | | | | | | | | | |
| 16 | AWC; Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 17 | AWC; Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 18 | AWC; Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 19 | AWC; Pct. of AWC / State | | in., Pct. | | | | | | | | | | | | | | |
| 20 | Total Avail. Water Capacity | | Inches | | | | | | | | | | | | | | |
| 21 | Avail. Water Present | | Inches | | | | | | | | | | | | | | |
| 22 | Avail. Water Deficit | | Inches | | | | | | | | | | | | | | |
| 23 | Anticipated Yields | | | | | | | | | | | | | | | | |

| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAP UNIT DERIVED | USE DEPENDENT | | | | | | | | | | | | |
| | | | | | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
| 24 | WEQ I | | T/Ac/Y | | | | | | | | | | | | | | |
| 25 | WEQ K | | | | | | | | | | | | | | | | |
| 26 | WEQ C | | | | | | | | | | | | | | | | |
| 27 | WEQ L | | Ft | | | | | | | | | | | | | | |
| 28 | WEQ V (SGe) | | Lbs/Ac | | | | | | | | | | | | | | |
| 29 | WEQ Soil Loss | | T/Ac/Y | | | | | | | | | | | | | | |
| 30 | USLE R | | | | | | | | | | | | | | | | |
| 31 | USLE K | | | | | | | | | | | | | | | | |
| 32 | USLE L | | Ft. | | | | | | | | | | | | | | |
| 33 | USLE S | | Pct. | | | | | | | | | | | | | | |
| 34 | USLE LS | | | | | | | | | | | | | | | | |
| 35 | USLE C | | | | | | | | | | | | | | | | |
| 36 | USLE P | | | | | | | | | | | | | | | | |
| 37 | USLE Soil Loss | | T/Ac/Y | | | | | | | | | | | | | | |
| 38 | Soil Condition Rating Index, Overall | | | | | | | | | | | | | | | | |
| 39 | Soil Condition Rating Index, Crop | | | | | | | | | | | | | | | | |
| 40 | Soil Condition Rating Index, Tillage | | | | | | | | | | | | | | | | |
| 41 | Soil Condition Rating Index, Mulch | | | | | | | | | | | | | | | | |
| 42 | Soil Condition Rating Index, Erosion | | | | | | | | | | | | | | | | |
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DATE
COMPILED BY

EXAMPLES

# FIELD WATER STATUS WORKSHEET

Example.

**County:** Carson
**Mapping** Unit **Name:** Pullman SICL ;PUA
Cropping **Sequence:** Wheat-Wheat

| KIND OF INFORMATION | | UNITS | QUANTITIES ASSIGNED J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tillage Operations | | | Grow | ing | wheat | ——— | ———> | harvest | chisel | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Lower tillage zone density | | gm/cc | 1.90 | 1.40 | 1.90 | 1.90 | 1.90 | 1.90 | 1.15 | | | | | |
| Crust Expression | | | w-2 | w-2 | w-2 | w-2 | w-2 | w-2 | wy-1 | | | | | |
| Root Depth | | Inches | 30 | 42 | 42 | 60 | 70 | 70 | — | — | — | — | — | — |
| Evapotranspiration 1/ | | Inches | 1.24 | 1.40 | 2.17 | 4.50 | 7.75 | 4.24 | 1.60 | | | | | |
| Precipitation (Net) 2/ | | Inches | 0.5 | 0.7 | 1.0 | 1.0 | 2 50 | 2 50 | 3.55 | | | | | |
| Irrigation (Net) 3/ | | Inches | | | | | 6 00 | | | | | | | |
| Soil Moisture Difference | | Inches | -0.74 | -0.70 | -1.17 | -3.5 | +0.75 | -1.74 | +1.95 | | | | | |
| Monthly Water Balance 4/, 5/ | DEPTH (INCHES) | AWC Inches | 8.00 | 7.3 | 6.13 | 2.63 | 3.38 | 1.64 | 3.59 | | | | | |
| Layer 1 | 0-7 | 1.33 | 40 | 30 | 20 | 10 | 50 | 10 | 75 | | | | | |
| Layer 2 | 7-20 | 2.86 | 61 | 51 | 40 | 30 | 35 | 13 | 51 | | | | | |
| Layer 3 | 20-40 | 4.00 | 68 | 55 | 45 | 40 | 40 | 13 | 13 | | | | | |
| Layer 4 | 40-70 | 5.10 | 74 | 74 | 72 | 65 | 65 | 12 | 12 | | | | | |
| Layer 5 | | | | | | | | | | | | | | |
| | 70 | 13.30 | | | | | | | | | | | | |
| Deep Drainage Loss | | Inches | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |

1/ For fallow periods, use Display 16 - 2; For growing crops, refer to applicable evapo-transpiration curves.

2/ From Oisplay A - 71 applicable Soil Series cumulative infiltration chart on conservation tillage, or continuous small grain with conventional tillage to applicable percentage based on crust expression.

3/ From Display 16 - 3 applicable Soil Series Cumulative infiltration chart. or sprinkler evaluation summaries.

4/ End of Month Balance only. Enter in appropriate blank on Soil Properties Record.

5/ 00 not show water increases in next lower layer until upper layer exceeds 50% and approaches 75%.

MAP UNIT Pullman Clay loam; PuA
PERMANENT PRACTICES
CALENDER YEAR USE Grain Sorghum
ROTATION Wheat-Grain Sorghum-Fallow(irrigated, furrow diked)
WATER REGIME Average

# SOIL PROPERTIES RECORD

EXAMPLE

LOCATION Carson County, Texas
RECORD NO. TX055-001
USE CODE SSR

## OPERATION SCHEDULE

| | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prior year: | | | | | | | Harvest wheat Disk | Sweep | Graze volunteer Wheat through December - | | | |
| Current year: | Sweep | Chisel in Anhydrous Ammonia | Springtooth Harrow | | Sweep | Plant | Cultivate Dike Fls. Furrows Irrigate | Irrigate | | Harvest | Graze | Graze |

| LINE NO | KIND OF ENTRY | ENTRY NUMBERS | UNITS | MAP UNIT DERIVED | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Surface Crust - Resistance Thickness | | 1.33 in. | | | W-2 | W-2 | W-2 | W-2 | W-1 | W-1 | W-2 | W-3 | W-3 | W-3 | W-2 | W-2 |
| 2 | Upper Tillage Zone-Thickness | | Inches | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 3 | Upper Tillage Zone-Density | | gm cc | | | [illegible] | 1.22 | 1.23 | 1.45 | 1.33 | 1.35 | 1.37 | 1.35 | 1.35 | 1.40 | 1.40 | 1.45 |
| 4 | Lower Tillage Zone-Thickness | | Inches | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Lower Tillage Zone-Density | | gm/cc | | | 1.55 | 1.55 | 1.55 | 1.5[illegible] | 1.60 | 1.67 | 1.5[illegible] | 1.60 | 1.67 | 1.55 | 1.55 | 1.65 |
| 6 | Upper Subsoil-Density | | gm cc | | 1.50 | | | | | | | | | | | | |
| 7 | Final Infiltration Rate | | in hr | | | 0.07 | 0.01 | 0.07 | [illegible] | 0.0[illegible] | 0.06 | 0.0[illegible] | 0.06 | 0.7[illegible] | 0.06 | 0.25 | 0.05 |
| 8 | Design Intake Family | | | .3 | | | | | | | | | | | | | |
| 9 | Expected Net Furrow Intake (?? hrs) | | Inches | | | 4.90 | 4.90 | 4.90 | 4.90 | 4.20 | 4.20 | 4.3[illegible] | 4.80 | 4.9[illegible] | 4.50 | 4.50 | 4.50 |
| 10 | Effective Hydrologic Group | | | | | D | D | D | D | D | D | D | D | D | D | D | D |
| 11 | Antecedent Moisture Condition | | | | | I | II | II | II | II | II | I | I | I | I | I | II |
| 12 | Hydrologic Soil Cover Complexes | | | | | FTGS | FTGP | FTG[illegible] | FTGR | FTGP | RTGP | RT[illegible] | RTPG | RTP[illegible] | RTPG | RTGG | RTGG |
| 13 | Runoff Curve Number | | | | | 75 | 90 | 90 | 90 | 90 | 87 | 75 | 75 | 75 | 75 | 75 | 85 |
| 14 | Depth Common Rootsior Tap Roots | | Inches | | | | | | | | 12 | [illegible] | 30 | 35 | 30 | | |
| 15 | Depth Few Roots | | Inches | | | | | | | | 23 | [illegible] | 70 | 7[illegible] | 70 | | |
| 16 | AWC, Pct. of AWC State | | in., Pct. | 2.33 | | [illegible] | 55[illegible] | 5[illegible] | [illegible] | 65[illegible] | 4[illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 46%S | [illegible] |
| 17 | AWC, Pct. of AWC State | | in., Pct. | 2.86 | | [illegible] | [illegible] | 62[illegible] | [illegible] | [illegible] | 60[illegible] | [illegible] | 30%S | [illegible] | [illegible] | [illegible] | [illegible] |
| 18 | AWC Pct. of AWC State | | in., Pct. | 4.06 | | [illegible] | 20%S | [illegible] | [illegible] | [illegible] | 27%S | [illegible] | 15[illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 19 | AWC, Pct. of AWC State | | in., Pct. | 5.[illegible] | | 12%S | [illegible] | 18%S | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10%S | [illegible] |
| 20 | Total Avail. Water Capacity | | Inches | 12.3 | | | | | | | | | | | | | |
| 21 | Avg Water Present | | Inches | | | [illegible] | [illegible] | [illegible] | [illegible] | 4.55 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 2.14 | [illegible] |
| 22 | Avg Water Deficit | | Inches | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 23 | Estimated Yields | | lbs Ac | | [illegible] | | | | | | | | | | | | |

EXAMPLE

# FIELD WATER STATUS WORKSHEET

County: Carson
Mapping Unit Name: PUA
Cropping Sequence: Grain Sorghum

| KIND OF INFORMATION | | UNITS | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | QUANTITIES ASSIGNED | | | | | | | | | | | |
| Tillage Operations | | | Sweep | Chisel | Harrow | - | Sweep | Plant | Cult | | | Harvest | Graze | |
| | | | | | | | | | Dike | | | | | |
| | | | | | | | | | | | | | | |
| Lower tillage zone density | | gm/cc | 1.55 | 1.55 | 1.55 | 1.55 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.65 | 1.65 | 1.65 |
| Crust Expression | | | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | M-3 | 3 | 3 | 3 |
| Root Depth | | Inches | | | | | | 20 | 48 | 70 | 70 | 70 | | |
| Evapotranspiration 1/ | | Inches | 0.33 | .53 | 0.75 | 0.93 | 1.06 | 2.00 | 7.75 | 7.50 | 2.38 | .86 | 0.60 | 0.47 |
| Precipitation (Net) 2/ | | Inches | 0.50 | 0.7 | 1.0 | 1.0 | 1.65 | 1.70 | 1.75 | 1.75 | 1.60 | 1.30 | 0.60 | .60 |
| Irrigation (Net) 3/ | | Inches | | | | | | | 5.0 | 5.0 | | | | |
| Soil Moisture Difference | | Inches | +.17 | +.17 | +.25 | +.07 | +.59 | -.30 | -1.0 | -.75 | -.78 | +.44 | 0 | +.13 |
| Monthly Water Balance 4/, 5/ | DEPTH (INCHES) | AWC Inches | 3.45 | 3.62 | 3.87 | 3.94 | 4.53 | 4.23 | 3.23 | 2.48 | 1.70 | 2.14 | 2.14 | 2.27 |
| Layer 1 | 0 - 7 | 1.33 | 43 | 56 | 65 | 65 | 65 | 42 | 30 | 20 | 13 | 46 | 46 | 56 |
| Layer 2 | 7 - 20 | 2.86 | 42 | 42 | 47 | 49 | 60 | 60 | 40 | 30 | 14 | 14 | 14 | 14 |
| Layer 3 | 20 - 40 | 4.00 | 20 | 20 | 20 | 20 | 27 | 27 | 20 | 15 | 13 | 13 | 13 | 13 |
| Layer 4 | 40 - 70 | 5.10 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 15 | 12 | 12 | 12 | 12 |
| Layer 5 | Total | 13.3 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Deep Drainage Loss | | Inches | | | | | | | | | | | | |

1/ For fallow periods, use Display 16 - 2; For growing crops, refer to applicable evapo-transpiration curves.

2/ From Display A - 71 applicable Soil Series cumulative infiltration chart on conservation tillage, or continuous small grain with conventional tillage to applicable percentage based on crust expression.

3/ From Display 15 - 3 applicable Soil Series Cumulative infiltration chart, or sprinkler evaluation summaries

4/ End of [illegible] Balance only. Enter in appropriate blank on Soil Properties Record.

5/ [illegible] next lower layer until upper layer exceeds 50% and approaches 75%.

# SOIL PROPERTIES RECORD

E X A M P L E

MAP UNIT Pullman Clay loam; PUA
PERMANENT PRACTICES
CALENDER YEAR USE Fallow
ROTATION Grain Sorghum-Fallow-Wheat(Irrigated)
WATER REGIME Average

LOCATION Carson County, Texas
RECORD NO. TX065-002
USE CODE FAL

OPERATION SCHEDULE

| | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prior year: | | | | | | | | | | Harvest | Graze | Graze |
| Current year: | Graze | Graze | Graze | Sweep 4" | Sweep 4" | Sweep 4" | | Sweep 0" Fertilize List | Drill Wheat | Irrigate | Graze | Graze |

| LINE NO | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED: MAP UNIT DERIVED | USE DEPENDENT: YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Surface Crust – Resistance Thickness | | 1/32 in. | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 2 | Upper Tillage Zone-Thickness | | inches | | | 6 | 8 | 4 | 6 | 4 | 4 | 4 | 7 | 4 | 9 | 4 | 4 |
| 3 | Upper Tillage Zone-Density | | gm cc | | | 1.45 | 1.45 | 1.50 | [illegible] | 1.20 | 1.20 | [illegible] | 1.15 | [illegible] | [illegible] | [illegible] | [illegible] |
| 4 | Lower Tillage Zone-Thickness | | inches | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 3 | 3 | 3 | 3 |
| 5 | Lower Tillage Zone-Density | | gm cc | | | 1.64 | 1.65 | 1.67 | 1.64 | 1.45 | 1.66 | 1.45 | 1.15 | 1.30 | 1.30 | [illegible] | [illegible] |
| 6 | Upper Subsoil Density | | gm cc | | 1.50 | | | | | | | | | | | | |
| 7 | Final Infiltration Rate | | in hr | | | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | [illegible] | 0.17 | 0.15 | 0.15 | [illegible] | 0.14 |
| 8 | Design Intake Family | | | NT | | | | | | | | | | | | | |
| 9 | Expected Net Furrow Intake (24 hrs) | | inches | | | [illegible] | [illegible] | 4.9 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 10 | Effective Hydrologic Group | | | | | D | D | D | D | D | C | C | C | C | C | C | C |
| 11 | Antecedent Moisture Condition | | | | | II | II | II | I | I | I | II | II | II | II | II | II |
| 12 | Hydrologic Soil Cover Complexes | | | | | PTCG | PTCG | PTCG | FTCG | FTCG | FTCG | FTCG | [illegible] | STPP | STPP | [illegible] | [illegible] |
| 13 | Runoff Curve Number | | | | | 85 | 85 | [illegible] | [illegible] | 78 | [illegible] | 90 | 93 | 87 | 87 | [illegible] | [illegible] |
| 14 | Depth Common Roots(or Tap Root) | | inches | | | | | | | | | | | 5 | 14 | 16 | [illegible] |
| 15 | Depth Few Roots | | inches | | | | | | | | | | | 12 | 24 | 30 | [illegible] |
| 16 | AWC, Pct. of AWC State | | in., Pct. | 1.33 | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 17 | AWC, Pct. of AWC State | | in., Pct. | 2.86 | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 18 | AWC, Pct. of AWC State | | in., Pct. | 4.00 | | [illegible] | 120S | 120S | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 19 | AWC, Pct. of AWC State | | in., Pct. | 5.10 | | [illegible] | 120S | 120S | [illegible] | [illegible] | [illegible] | 120S | 120S | [illegible] | [illegible] | [illegible] | [illegible] |
| 20 | Total Avail. Water Capacity | | inches | 13.31 | | | | | | | | | | | | | |
| 21 | Avail. Water Present | | inches | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 3.43 | [illegible] | 3.54 | 4.15 | [illegible] | [illegible] | [illegible] |
| 22 | Avail. Water Deficit | | inches | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 23 | Anticipated Yields | | | | | | | | | | | | | | | | |

| LINE NO. | KIND OF EVENT | EVENT NUMBERS | UNITS | MAP UNIT DERIVED | VALUES ASSIGNED | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | USE DEPENDENT | | | | | | | | | | | | |
| | | | | | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
| 24 | WEQ I | | T/Ac/Y | | | 21 | 21 | 21 | 12 | 12 | 12 | 12 | 12 | 12 | 21 | 21 | 21 |
| 25 | WEQ K | | | | | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| 26 | WEQ C | | | 80 | | | | | | | | | | | | | |
| 27 | WEQ L | | Ft. | 3000 | | | | | | | | | | | | | |
| 28 | WEQ V (3Gr) | | Lbs./Ac | | | 3200 | 2500 | 2400 | 2200 | 1950 | 1750 | 1750 | 300 | 300 | 350 | 500 | 500 |
| 29 | WEQ Soil Loss | | T/Ac/Y | | 0.57 | | | | | | | | | | | | |
| 30 | USLE R | | | 120 | | | | | | | | | | | | | |
| 31 | USLE K | | | 0.37 | | | | | | | | | | | | | |
| 32 | USLE L | | Ft | 400 | | | | | | | | | | | | | |
| 33 | USLE S | | Pct. | 0.50 | | | | | | | | | | | | | |
| 34 | USLE LS | | | 0.13 | | | | | | | | | | | | | |
| 35 | USLE C | | | | 0.1 | | | | | | | | | | | | |
| 36 | USLE P | | | | 1.0 | | | | | | | | | | | | |
| 37 | USLE Soil Loss | | T/Ac/Y | | 0.27 | | | | | | | | | | | | |
| 38 | Soil Condition Rating Index, Overall | | +0.[illegible] | | | | | | | | | | | | | | |
| 39 | Soil Condition Rating Index, Crop | | -0.5 | | | | | | | | | | | | | | |
| 40 | Soil Condition Rating Index, Tillage | | -0.2 | | | | | | | | | | | | | | |
| 41 | Soil Condition Rating Index, Mulch | | - | | | | | | | | | | | | | | |
| 42 | Soil Condition Rating Index, Erosion | | +0.[illegible] | | | | | | | | | | | | | | |

DATE 1/85

COMPILED BY Pringle, Walker,
Allison, Blackwell, Purnell

E X A M P L E

# FIELD WATER STATUS WORKSHEET

County: Carson
Mapping Unit Name: PUA
Cropping Sequence: Fallow

| KIND OF INFORMATION | UNITS | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | QUANTITIES ASSIGNED | | | | | | | | | | | |
| Tillage Operations | | Graze | | | Sweep | Sweep | Sweep | | Blade | Drill | Irrig | Graze | |
| | | | | | | | | | Sweep | | | | |
| | | | | | | | | | 6" | | | | |
| Lower tillage zone density | gm/cc | 1.65 | 1.65 | 1.65 | 1.65 | 1.65 | 1.65 | 1.65 | 1.15 | 1.30 | 1.30 | 1.30 | 1.35 |
| Crust Expression | | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| Root Depth | Inches | | | | | | | | | 12 | 24 | 30 | 30 |
| Evapotranspiration 1/ | Inches | .47 | .60 | .86 | 1.26 | 1.26 | 1.39 | 1.26 | 1.80 | 1.80 | 1.50 | 1.20 | 1.24 |
| Precipitation (Net) 2/ | Inches | .5 | .7 | 1.0 | 1.0 | 1.40 | 1.40 | 1.40 | 2.6 | 1.6 | 1.30 | .6 | .6 |
| Irrigation (Net) 3/ | Inches | | | | | | | | | | 7.0 | | |
| Soil Moisture Difference | Inches | +03 | +.1 | +.14 | -26 | +.14 | +.01 | +.14 | +1.27 | +.30 | +6.8 | -.6 | -.64 |
| Monthly Water Balance 4/, 5/ DEPTH (INCHES) | AWC Inches 2.27 | 2.30 | 2.40 | 2.54 | 2.28 | 2.42 | 2.43 | 2.57 | 3.84 | 4.14 | 10.94 | 10.34 | 9.7 |
| Layer 1 | | 58 | 58 | 58 | 38 | 49 | 50 | 60 | 60 | 65 | 75 | 50 | 40 |
| Layer 2 | | 14 | 17 | 22 | 22 | 22 | 22 | 22 | 60 | 65 | 90 | 81 | 71 |
| Layer 3 | | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 18 | 20 | 90 | 90 | 85 |
| Layer 4 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 74 | 74 | 74 |
| Layer 5 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Deep Drainage Loss | Inches | | | | | | | | | | | | |

1/ For fallow periods, use Display 16 - 2; For growing crops, refer to applicable evapo-transpiration curves.

2/ From Display A - 71 applicable Soil Series cumulative infiltration chart on conservation tillage, or continuous small grain with conventional tillage to applicable percentage based on crust expression.

3/ From Display 16 - 3 applicable Soil Series Cumulative infiltration chart, or sprinkler evaluation summaries.

4/ End of Month Balance only. Enter in appropriate blank on Soil Properties Record.

5/ Do not show water increases in each lower layer until upper layer exceeds 50% and sometimes 75%.

MAP UNIT Pullman Clay loam, 0-1%
PERMANENT PRACTICES
CALENDER YEAR USE Wheat
ROTATION Grain sorghum-Fallow-Wheat(irrigated)
WATER REGIME Average

# SOIL PROPERTIES RECORD

LOCATION Carson County, Texas
RECORD NO. [illegible]
USE CODE [illegible]

OPERATION SCHEDULE

| | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prior year: | | | | | | | | | Drill wheat | Irrigate | Graze | Graze |
| Current year: | Graze | Graze | Graze to 3/15 | | Irrigate | | Harvest Tandem Disk | Sweep 4" | Graze volunteer wheat through December 31 | | | |

| LINE NO. | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED: MAP UNIT DERIVED | USE DEPENDENT: YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Crust - Resistance/Thickness | 0019,C01 | lb/in. | | | W-2 | [illegible] | W-2 | W-2 | W-2 | W-2 | W-1 | W-1 | W-2 | W-3 | W-3 | W-3 |
| 2 | Upper Tillage Zone-Thickness | 0029,C01 | Inches | | | 4 | [illegible] | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 3 | Upper Tillage Zone-Density | 0038,C01 | gm/cc | | | 1.35 | 1.35 | 1.40 | 1.40 | 1.40 | 1.40 | 1.15 | 1.15 | 1.25 | 1.30 | 1.35 | 1.40 |
| 4 | Lower Tillage Zone-Thickness | 0048,C01 | Inches | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Lower Tillage Zone-Density | 0058,C01 | gm/cc | | | 1.35 | 1.35 | 1.40 | 1.40 | 1.40 | 1.40 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 |
| 6 | Upper Subsoil-Density | 0068,C01 | gm/cc | | 1.55 | | | | | | | | | | | | |
| 7 | Final Infiltration Rate | 0076,C01 | in/hr | | | 0.14 | 0.14 | 0.13 | 0.13 | 0.13 | 0.13 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 8 | Design Intake Family | 0088,C01 | | NT | | | | | | | | | | | | | |
| 9 | Expected Net Furrow Intake (24 hrs) | 0098,C01 | Inches | | | 6.7 | 6.7 | 6.2 | 6.2 | 5.2 | 5.2 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 |
| 10 | Effective Hydrologic Group | 0109,C01 | | | | C | C | C | C | C | C | D | D | D | D | D | D |
| 11 | Antecedent Moisture Condition | 0118,C01 | | | | II | I | I | I | II | I | I | II | II | II | I | I |
| 12 | Hydrologic Soil Cover Complexes | 0129,C01 | | | | STPG | STPG | STPG | STPG | STPG | STPG | FTCR | FTCR | FTCR | FTCR | FTCR | FTCR |
| 13 | Runoff Curve Number | 0138,C01 | | | | 77 | 73 | 73 | 73 | 56 | 72 | 78 | 90 | 90 | 90 | 78 | 78 |
| 14 | Depth Common Rootstor (Tap Root) | 0148,C01 | Inches | | | 18 | [illegible] | 30 | 30 | 10 | 30 | | | 5 | 14 | 15 | 15 |
| 15 | Depth Few Roots | 0158,C01 | Inches | | | 40 | [illegible] | 60 | 70 | 70 | 70 | | | 12 | 20 | 20 | 20 |
| 16 | AWC; Pct. of AWC State | 016801 | in., Pct. | 1.33 | | 30MS | [illegible] | 25MS | 22MS | 60[illegible] | 25MS | 31MS | 65[illegible] | 66[illegible] | 70[illegible] | 40MS | 30MS |
| 17 | AWC; Pct. of AWC State | 016801 | in., Pct. | 2.96 | | 51[illegible] | 4[illegible]MS | 30MS | 25MS | 35MS | 20MS | 20MS | 20MS | 19MS | 51[illegible] | 46MS | 40MS |
| 18 | AWC; Pct. of AWC State | 016801 | in., Pct. | 4.00 | | 24[illegible] | [illegible] | 64[illegible] | 25MS | 25MS | 20MS | 20MS | 20MS | 20MS | 20MS | 25MS | 22MS |
| 19 | AWC, Pct. of AWC State | 016801 | in., Pct. | 5.10 | | 74[illegible] | [illegible] | 52[illegible] | 31MS | 31MS | 18MS | 18MS | 15MS | 12MS | 12MS | 15MS | 12MS |
| 20 | Total Avail. Water Capacity | 0178,C01 | Inches | 13.3 | | | | | | | | | | | | | |
| 21 | Avail. Water Present | 0188,C01 | Inches | | | 8.95 | 8.26 | 7.09 | 3.59 | 4.34 | 2.60 | 2.68 | 3.15 | 3.69 | 4.09 | 3.54 | 3.29 |
| 22 | Avail. Water Deficit | 0195,C01 | Inches | | | 4.35 | [illegible] | 6.21 | 9.71 | 8.96 | 10.7[illegible] | 10.6[illegible] | 10.15 | 9.61 | 9.21 | 9.76 | 10.02 |
| 23 | Anticipated Yields | 0208,C01 | Bu/Ac | | 52 | | | | | | | | | | | | |

| LINE NO | KIND OF ENTRY | ENTRY NUMBERS | UNITS | VALUES ASSIGNED | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAP UNIT DERIVED | USE DEPENDENT | | | | | | | | | | | | |
| | | | | | YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
| 24 | WEQ I | 021B.C01 | T/Ac/Y | | | 21 | 21 | 21 | 21 | 21 | 21 | 12 | 12 | 12 | 21 | 21 | 21 |
| 25 | WEQ K | 022B.C01 | | | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 1.0 | 0.75 | 0.75 | 1.0 | 1.0 | 1.0 |
| 26 | WEQ C | 023B.C01 | | 80 | | | | | | | | | | | | | |
| 27 | WEQ L | 024B.C01 | Ft | 3000 | | | | | | | | | | | | | |
| 28 | WEQ V (SGe) | 025B.C01 | Lbs/Ac | | | 500 | 800 | 1600 | 3200 | 5000 | 5000 | 3800 | 3400 | 3400 | 3400 | 3400 | 3400 |
| 29 | WEQ Soil Loss | 025B.C01 | T/Ac/Y | | [illegible] | | | | | | | | | | | | |
| 30 | USLE R | 027A01 | | 120 | | | | | | | | | | | | | |
| 31 | USLE K | 028A01 | | 0.37 | | | | | | | | | | | | | |
| 32 | USLE L | 029A01 | Ft. | 400 | | | | | | | | | | | | | |
| 33 | USLE S | 030A01 | Pct. | 0.59 | | | | | | | | | | | | | |
| 34 | USLE LS | 031A01 | | 0.13 | | | | | | | | | | | | | |
| 35 | USLE C | 032B.C01 | | | [illegible] | | | | | | | | | | | | |
| 36 | USLE P | 033A01 | | | [illegible] | | | | | | | | | | | | |
| 37 | USLE Soil Loss | 034B.C01 | T/Ac/Y | | [illegible] | | | | | | | | | | | | |
| 38 | Soil Condition Rating Index, Total | 035B.C01 | +1.6 | | | | | | | | | | | | | | |
| 39 | Soil Condition Rating Index, Crop | 036B.C01 | 2.0 | | | | | | | | | | | | | | |
| 40 | Soil Condition Rating Index, Tillage | 037B.C01 | -0.4 | | | | | | | | | | | | | | |
| 41 | Soil Condition Rating Index, Mulch | 038B.C01 | - | | | | | | | | | | | | | | |
| 42 | Soil Condition Rating Index, Erosion | 039B.C01 | +2.0 | | | | | | | | | | | | | | |

DATE
COMPILED BY

# FIELD WATER STATUS WORKSHEET

County: Carson
Mapping Unit Name: Pullman Clay loam, PUA
Cropping Sequence: Wheat

EXAMPLE

| KIND OF INFORMATION | UNITS | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | QUANTITIES ASSIGNED | | | | | | | | | | | |
| Tillage Operations | | Graze | | | | Irrigate | | Harvest | Sweep | Graze | Volunteer | | |
| | | | | | | | | Disk | | | | | |
| | | | | | | | | | | | | | |
| Lower tillage zone density | gm/cc | 1.35 | 1.35 | 1.40 | 1.40 | 1.40 | 1.40 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 |
| Crust Expression | | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| Root Depth | Inches | 40 | 48 | 60 | 70 | 70 | 70 | | | 6 | 20 | 20 | 20 |
| Evapotranspiration 1/ | Inches | 1.24 | 1.40 | 2.17 | 4.50 | 7.75 | 4.24 | 1.72 | 1.33 | 1.06 | 0.9 | 1.15 | .25 |
| Precipitation (Net) 2/ | Inches | .5 | .7 | 1.0 | 1.0 | 2.50 | 2.50 | 1.80 | 1.80 | 1.60 | 1.30 | .6 | .6 |
| Irrigation (Net) 3/ | Inches | | | | | 5.00 | | | | | | | |
| Soil Moisture Difference | Inches | -.74 | -.7 | -1.17 | -3.5 | +.75 | -1.74 | +.08 | +.47 | +.54 | +.10 | -.55 | -.26 |
| Monthly Water Balance 4/, 5/ DEPTH (INCHES) | AWC Inches 9.7 | 8.96 | 8.26 | 7.09 | 3.59 | 4.34 | 2.6 | 2.65 | 3.15 | 3.69 | 4.09 | 3.54 | 3.28 |
| Layer 1 | | 30 | 30 | 25 | 25 | 60 | 25 | 31 | 66 | 66 | 70 | 40 | 30 |
| Layer 2 | | 51 | 41 | 30 | 25 | 35 | 20 | 20 | 20 | 32 | 51 | 46 | 42 |
| Layer 3 | | a4 | 74 | 64 | 25 | 25 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Layer 4 | | 74 | 74 | 66 | 31 | 31 | 18 | 18 | 18 | 18 | 18 | 18 | 8 |
| Layer 5 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Deep Drainage Loss | Inches | | | | | | | | | | | | |

1/ For fallow periods, use Display 16 - 2; For growing crops, refer to applicable evapo-transpiration curves.

2/ From Display A - 71 applicable Soil Series cumulative infiltration chart on conservation tillage, or continuous small grain with conventional tillage to applicable percentage based on crust expression.

3/ From Display 16 - 3 applicable Soil Series Cumulative infiltration chart, or sprinkler evaluation summaries.

4/ End of Month Balance only. Enter in appropriate blank on Soil Properties Record.

5/ Do not [illegible] water increases in next lower layer until upper layer exceeds 50% and approaches 75%.

COMMITTEE REPORT - 1986

Southern Regional Soil Survey Work-Planning
Conference Committee IV: Diagnostic Horizons

Committee Members:

Bob J. Miller, Chairman

| | |
|---|---|
| B. L. Allen | D. Lietzke |
| S. W. Buol | P. G. Martin |
| W. L. Cockerham | G. Mayhugh |
| W. Frye | D. Newton |
| T. R. Gerald | H. Smith |
| W. Henderson | W. I. Smith |
| R. B. Hinton | C. R. Stahnke |
| G. L. Lane | J. C. Williams |

Committee charges:

1. Continue efforts to improve definition of Natric horizons as they occur in the presence of gypsum and/or with high exchangeable aluminum content.

2. Serve as a sounding board for problems in use of new horizon designations. Investigate feasibility of establishing minimum requirements for using the lower case symbols.

Purpose:

"The purpose of the committee as currently structured is primarily educational rather than problem solving. Evaluation of where we are, what our problems are, and exploration or introduction of possible solutions and areas of additional study should be the focus of committee reports."

Approach:

1. The Committee Chairman solicited input from each committee member concerning questions and problems that should be considered in view of, and consistent with, the committee charges and stated purpose.

2. The Committee Chairman then summarized the various responses in the form of a questionnaire. The questionnaire was then mailed to each committee member for comments and suggestions in those areas in which the member wished to contribute.

3. The committee members response to the questionnaire were then summarized and preliminary recommendations made.

4. The preliminary recommendations were compiled as a preliminary report which served as reference material for, and a basis of, discussion during the conference.

5. Additonal recommendations and other changes approved during the Conference are incorporated in this final report.

Results:

The results of the committees work are organized as follows:

(a) The specific question or invitation to comment is given as it appeared on the initial questionnaire compiled from the committee members responses.

(b) This is followed by a summary of the committee members Initial responses.

(c) This is followed, in turn, by a recommendation based on the responses of the committee members and subsequent action taken during the Conference.

1. Question:
How can we emphasize to soil scientists that horizon designations and diagnostic soil horizons are not equivalent? For example, how do we get widespread acceptance that not all Bt horizons qualify for argillic, not all E horizons quality for albic, not all Btn horizons qualify for natric, etc.? Help!

Response :
There is a widespread and persistant tendency among many soil scientists to equate certain horizon designations and diagnostic soil horizons (i.e. Bt and argillic, E and albic, etc.) although this distinction is clearly and succicently made in the Soil Survey Manual (Page 4-40, 4th paragraph ).

Recommendation:
The distinction should be stressed with emphasis in NTC soil courses and workshops, in training

problem exists with Bk horizons. We may have A, Bt, Bk (strongly developed caliche) horizons and then a" underlying Bk with only films and threads of carbonate. A BCk would seem to be appropriate. I am sure similar situations prevail in upper Bt's. Are they transitional in all properties except for "thin, patchy" clay films. I have the impression that the Western Region is using lower case symbols with transition horizons more liberally than the Southern Region."

Recommendation:
No change is recommended with respect to the guidelines in the Soil Survey Manual (Pages 4-42, 4-43). **It is recommended** that transitional horizon designations of the form AB, EB, BE, BC, etc. be used to describe a significant horizon as contrasted to a horizon boundary for example.

3. Question:
When, or should, subscript horizon designations be used with transitional horizons? Are there cases where they should and others where they should not be used? Please comment on any specific examples you think should be considered.

Response:
There was a wide range of responses to this one. Most respondents were of the opinion that the use of subscript horizon designations under these conditions should be held to the minimum needed for clarification and explanatory purposes. Where they are needed for clarification and explanation should be left to the judgement of the person describing the soil. A few believed they should not be used at all. At least one person suggested that a committee should develop guidelines for their use for incorporation into the Soil Survey Manual.

Recommendation:
It is recommended that subscript horizon designations be used with transitional horizons in those cases where it is useful in clarification and explanation of the interpretation of the person(s) describing the soil. This places responsibility for deciding when and where to use the subscript designation on the person(s) that initially describes the pedon. It is important that the subscript designation be used with the proper component of the designation (i.e. Bt/R not B/Rt; E/Bh not Eh/B).

4. Question:
Is there a case for using lower case horizon symbols with certain horizons such as E/B, B/E, B/C? If so, can you give examples and reasons?

Response:
Although not unanimous, the majority response was that lower case symbols should be used in such cases if it helps in explaining and clarifying the nature and relationship of the 'mixed' horizons. At least two respondents indicated that lower case symbols should not be used under these circumstances.

Recommendation:
Same as recommendation for preceding number 3.

5. **Question:**
The use of certain combinations of lowercase horizon designations are 'prohibited'. Do any of the prohibited cases cause problems? If so, which ones and what are the problems?

Response:
The general response was that the 'prohibited' combinations were not a problem in describing and horizonating soils. However, it was pointed out that there are instances in which the use of prohibited combinations would be advantageous. For example, an Ap horizon in a field that has been previously irrigated and abandoned because of high salt accumulations could be designated Apz which would convey information about the horizon that might require several words of narrative description. The following response also indicates a desirable use of a 'prohibited' combination. "I would like to be able to use a Bwk designation. As it is now we are using only Bk. But many Bk's are massive. The use of the combination, "wk", would indicate that there is pedogenic development in addition to an accumulation of carbonate. In general, I think restrictions on combinations of lower case symbols should be minimal. However, one precaution: lets not fall into the trap of using Bw symbols for transitional horizons."

Recommendation:
It is recommended that use of those lower case letter suffixes (k, n, y and z) that indicate secondary accumulations of relatively soluble soil constituents be allowed in combination with any other lower case letter suffixes. Climatic, hydrologic and other changes can and do result in secondary accumulation of these relatively soluble components in unique combinations with other soil features.

6. Queston:
The natric horizon presents a number of problems.
A. What kind(s) of horizon designations do soil scientists in your area use on natric horizons?

Response to Part A:
Respondants from areas having natric horizons indicated that the Btn designation is commonly used. Certain problems identified with respect to the use of the subscript n are outlined under item 9. There is a general view that to limit the use of the subscript n to the natric horizon would be too restrictive.

Recommendation regarding Part A:
None except a reminder that the subscript n used with a Master Horizon designation is not equivalent to identifying the horizon as 'natric'.

B. what, if any, are the problems field soil scientists have in identifying natric horizons and what can be done to alleviate the problems?

Response to Part B:
The problem of recognizing natric horizons In the field is generally recognized by the respondants. The 'classical' natric horizons do not seem to cause much trouble. Natrlc horizon that have acid reactions, those with well expressed blocky structure, and those that are marginal in other ways, cause the most difficulty. With these, native plants, landscape position and other indicators are used to suggest where natric horizons may be present. Laboratory analyses must be relied on to document the levels of Na present.

Recommendation for Part B:
It is recommended that this committee or other appropriate committee be charged with determining whether useful field criteria can be established for recognition of sodlc conditions. It is also recommended that laboratory analyses of pedons routinely include analysis for Na to help Identify high Na levels where they occur and are not suspected. It is recommended that more 'grab' or 'spot check' samples be submitted for percent saturation with exchangeable Na determinations to better describe the ranges occurring in the soils. It is recommended that the possibility of developing a quick and inexpensive field test for exchangeable Na levels be explored by the Lincoln laboratory. Finally, itis recommended that those states (Arkansas, Kentucky, Louisiana, Mississlppl, Texas, Virginia, Florida) having soils with natrlc horizons that are difficult or Impossible to recognize in the field, work cooperatively to develop a set (combination) of indicators for use in helping the soil scientists identify the condition.

7. Question:
Natric subgroups are defined for some Great Groups. Other than soil series criteria, there is no means in Soil Taxonomy to identify Na problems at either depths greater or levels less than those required In the natric horizon. The natric horizon defines a severe Na problem but no high Na intergrades are defined. A subgroup Is needed to classify soils having Na levels high enough and at depth shallow enough to be a problem with growth of plants but that doesn't meet the criteria for a natric horizon. What is your reaction to the following possible subgroup for use in appropriate Great Groups? Although the following is not in the correct format for Soil Taxonomy Proposals, it could be put in the proper format if the decision is to prepare it.

Subgroup name : Solodic

Subgroup Characteristics: Either has

(a) SAR $\geq$ 6 (?) (or 7 percent or more saturations with exchangeable sodium) in some subhorizon at a depth greater than 40 cm below the top of the argillic horizon and within a depth of 1.25 meters below the surface whichever is the shallower, or

(b) More exchangeable magnesium plus sodium than calcium plus exchange acidity (at pH 8.2) in some subhorizon within the depths outlined in (a).

Response:
The general response was that this is a needed subgroup. Fairly large areas of these kinds of soils occur in Louisiana and Mississippi. They probably occur in lesser relative amounts in Arkansas, Kentucky, Florida and Tennessee.

Recommendation:
It is recommended that this subgroup be proposed by the workers in Louisiana. The proposed name, Solodic, suggests and extragrade rather than intergrade subgroup. Another name should be considered before the proposal is submitted for inclusion in Soil Taxonomy.

8. Quest ion:
How should we handle potentially toxic levels of exchangeable Al in the field soil survey and in the Soil Survey Reports and how does aluminum toxicity relate to the low base status of Kandi groups? Can you comment? (Note: It was intended that this be two separate questions but I missed it when I mailed the questionnaire.)

Response (exch. Al., field soil survey, soil survey reports):
There was general agreement that potentially toxic levels of exchangeable Al should be recognized and that users of the soil survey should he alerted as to the nature and extent of the potential problem. This has been satisfactorily done in, for example, the Morehouse Parish, Louisiana Soil Survey Report.

Recommendation:
It is recommended that, for soils having potentially toxic levels of exchangeable Al in a survey area, the soil survey report contain an indication of the levels of exchangeable Al in (1) the section containing the morphologic description of the soils, (2) the section on use and management of the soils, (3) the section dealing with the individual map units, and (4) the sections dealing with the natural fertility levels of the soils (in those reports that include such a section).

Response (Al toxicity-low base status-Kandi groups relationships):

(1) The Kandi horizon defines a textural analog of the argillic horizon having a low CEC par unit of clay (< 12 meq/100 g clay). There is no relationship to either base status (high or low) or to levels of exchangeable Al (high or low).

(2) Successful attempts to evaluate soil properties or characteristics that can be directly related to Al toxicities show that potential Al toxicity is best defined by a ratio of $Al^{+++}$ to basic cations as extracted by a neutral salt (the most common being 1N KCl). The percent Al saturation on the basis of the Effective Cation Exchange Capacity (ECEC) can be determined from these data. The ECEC is for all practical purposes the CEC of the soil at the pH of the soil.

Probably the most widely used critical ratios (percent AI saturations) are less than about 20%, 20 to 60%, and greater than about 60%. These percentages correspond respectively to minimal or no Al toxicity problems, Al toxicity for sensitive crops (rye, alfalfa, etc.), Al toxicity for all but the most tolerant crops such as tea, rubber, etc.

Recommendation:
It is recommended that levels of exchangeable Al not be made diagnostic for soil classification at levels above the soil series.

9. Question:
The establishment of minimum requirements for use with certain lower case horizon symbols seems to have widespread support. Would you please briefly outline your thoughts on what the minimum requirement(s) (if any) should be for use of the following lower case horizon designations with which you have had experience?

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c: What are significant accumulations ---, etc.7

Response:
Almost everyone agreed that the amount of concretions present should exceed some minimum percent by volume for use of this designation. The different opinions of what this amount should be were 2, 5, 10, and 25% by volume.

Recommendation:
Following discussion during the conference, it is recommended that the decision as to what constitutes a significant accumulation be left to the person describing the soil, and that minimum requirements not be set.

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g: What is 'strong' gleying? Should there be color value and chroma criteria? Mottle criteria in recent soils such as alluvium? Is color alone an adequate criterion? How do we distinguish color due to pedologic gleying from gray geologic materials? Other?

Response:
There is general agreement with the guidelines on page 4-44 of the Soil Survey Manual. The consensus seems to be that the symbol 'g' should indicate gleying as a dominant process expressed in the horizon as reflected by soil colors with chroma of 2 or less in at least 50% of the horizon.

Recommendation:
It is recommended that use of the symbol 'g' continue as outlined on page 4-44 of the Soil Survey Manual.

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k: Is k used only with secondary accumulations of carbonates? What about calcareous parent material (i.e. loess, alluvium)?

Response :
There is general agreement among those responding that the 'k' designation should be used to indicate only secondary accumulations of carbonates. This is in keeping with the general philosophy of using lowercase horizon symbols to indicate pedogenic processes having significant expression in the soil. Some respondents thought the secondary accumulation should result in 5% or more carbonates than in the underlying horizon (or than was originally present).

Recommendation:
It is recommended that the symbol 'k' be used to indicate secondarv accumulations of carbonates. Soils developed in calcareous parent materials and lacking secondary accumulations of carbonates are adequately described as calcareous in the narrative of the description.

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n: Should physical characteristics associated with high Na levels be required7 How can Na accumulation be determined in the field at the time soils are described when chemical data are lacking? etc.?

Response:
Most respondants agree that physical properties associated with high Na levels should be evident. These include extensive tounging, grayish-silt coatings on Ped exteriors, tubular pores, prismatic or columnar structure, dispersed structureless condition and dispersed organic matter. A number of the committee are of the opinion that the use of 'n' should reflect secondary acculumations of Na but that the minimum levels required should be lower than required for natric horizons. Field kits (i.e. HACH) can be used to estimate Na levels in most cases.

The use of 'n' is a problem created only in part by the need for chemical data to determine Na levels. Another problem is that there is not a set of physical characteristics and/or soil reactions that can be reliably and universally used to indicate secondary accumulations ot Na. Some believe there is a general tendency to use 'n' only with horizons that are believed to qualify as natric. This is not consistent with the use of essentially all the other lower case symbols (especially k and y) in that it results in a one to one correspondence between a diagnostic horizon and use of a lower case symbol. Also secondary accumulations of Na develop in, for example, surface (AP) horizon under some conditions (i.e. some water management systems in rice production).

Recommendation:
It is recommended that the designation 'n' continue to be used to indicate secondary accumulation of sodium in amounts that exceed that originally present in the parent material and that may or may not meet requirements of natric horizons.

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o: What kind of residual accumulation, how much, and in what form (i.e. clays vs ironstone), etc.?

Response:
There was almost no response to this one. The point was made that the residual accumulation of sesquioxides did not refer to fe-oxide only and that it should be associated with a low CEC.

Recommendation:
It is recommended that the intent and expected use of this symbol 'o' be clarified. For example, does it apply only to sesquioxides such as those of Fe, Al, Ti? Is the intent to also include hydroxides of those elements as for example kaolinite? What indicator(s) do the field soil scientist rely on to identify the condition(s)? Is the intent merely to reflect a low CEC per unit of clay?

---

q: Do we have them in the Southern Region? If so how are they recognized7

Response:
Most of the respondents indicated that this symbol is not used In their area. The following response indicates that they are present together with other materials that have accumulated in parts of the region. "Yes, we have secondary silica accumulation in some of our ancient petrocalcics on the Texas High Plains. They do not usually seem to be associated with the present pedogenic environment, but they seem to be of pedogenic origin. I think the "q" should be used if it is a" obvious feature."

Recommendation:
No change in present guidelines.

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r: It has been suggested that this designation needs redefinition to restrict it to the zone between C horizon and bedrock and exclude dense basal till and other analogous zones and consolidated layers with high bulk densities? Comments? Proposed definition7

Response:
Most of those responding were in favor of redefinition so that r is restricted to use between c horizon and bedrock. There is a strongly held minority opinion among the respondents that it should be redefined and not be restricted to the zone between C and R, but should be allowed to include shale, soft sandstone and other horizons with predominately geologic 'rock' structure.

Recommendation:
It is recommended that this symbol(r) be used: (1) with 'C' to indicate layers of weathered rock that are Paralithlc-like or that meet the requirements of Paralithic material and that are normally underlain by consolidated or semi-consolidation bedrock, and (2) for nonlithified material having predominately geologic 'rock' structure such as shale and soft sandstone. The material can be dug with difficulty with a spade. The material may contain vertical cracks, but the horizontal spacing between the cracks should be 10 cm or more.

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v: Is presence of any plinthic material enough?

Response:
Different respondents suggested that different quantities of plinthite be present before the symbol v is used. These suggestions ranged from any plinthite, through 1%, 2% and 5%.

Recommendation:
It is recommended that this symbol be used to indicate the presence of plinthite in recognizable quantities.

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**w:** Is this used in both upper and lower solum; restricted to upper, lower solum. For example, are A-Bw-Bt-C, A-Bt-Bw-C, A-Bw-C horizon sequences all to be expected? Other?

Response:
There seems to be no problem with the definition as indicated by the various responses. There is considerable variation In the way the symbol is used. The majority of those responding were of the opinion that the most common “se is in horizon sequences such as A-Bw-C but that such sequences as A-Bw-Bt-C or A-Bt-Bw-C could and would occur. This is consistent with the definition in the Soil Survey Manual. It appears that in the upper solum the Bw may be analogous to some of the old $B_1$ horizons and in the lower solum analagous to some of the old $B_3$ horizons.

Recommendations:
It is recommended that this or other appropriate committee give further study to the “se of the "Bw" designation and to the “se of "w" with other lower case symbols.

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**x:** What percent should be brittle7 Is density enough and if so how dense should it be?

Response:
There is a concensus that density alone is not a satisfactory criterion. Different views on the percent by volume having brittleness that should be required were 40%, 30%, 25%, 10% and that no minimum volume requirement should be set.

Recommendation:
It is recommended that the symbol 'x' be used to indicate the presence of brittleness in a horizon with no requirement regarding volume of soil that is brittle.

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**y:** Is the presence of gypsum adequate?

Response:
There were not many responses to this one. The concensus seems to be that there should be a secondary accumulation of gypsum in excess of any amount initially present. In many (most) soils this would be any gypsum at all. In these cases, laboratory analyses would not be needed where gypsum could be identified in the field. In soils developed in parent materials containing gypsum, laboratory analyses could document the extent of any secondary accumulations of gypsum.

Recommendation:
It is recommended that the suffix 'y' be used to indicate secondary accumulations of gypsum in excess of that present in the initial parent material.

z: What should be criterion (criteria) for determining presence of salts? EC, other?

Response :
Few responded to this one as most of the region lacks soils with appreciable accumulations of soluble salts. The concensus seems to be that there should be a secondary accumulation of salts and that EC should be ≥ 4 millimhos. Visible salt crystals and/or 'films' or 'threads' of neutral salts would be morphological indicators of value in the field.

Recommendation:
It is recommended that the use of "z" be based on morphological and other features that can be recognized in the field.

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d: This subscript has been suggested for use to indicate nongenetic fragipan-like layers such as dense basal till etc.that do not meet the criteria for "r". Comments? Proposed definition7

Response:
There is general support for introduction of this symbol for use in nongenetic 'fragipan-like' layers. The following possible definition was offered: "This symbol is used to indicate nongenetic firmness, brittleness, or high bulk density. Layers with these features have the same influence on use and management of the soil as a fragipan."

Recommendation:
It is recommended that this symbol be used to indicate nongenetic firmness, brittleness, or high bulk density such as occurs. in dense basal tills.

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10. I have paraphrased the following three comments from the committee for your consideration. They make good points on matters of concern to the committee. Please feel free to respond or comment as (and if) you wish.

(a) We do not need more diagnostic horizons because specific criteria need to relate directly to separations of pedons within higher taxa. Diagnostic horizons are in effect super categories, i.e. above the order category. Over the years we have found it necessary to subdivide most diagnostic horizons within the various categories. For example, the various kinds of argillic,mollic and spodic, etc. used as criteria within various categories.

Response to Part (a):
All responses were in agreement or noncommital.

Recommendation regarding Part (a):
It is recommended that this be the committees 'statement of philosophy' with respect to present status in the Region.

(b) At this stage in the "se of Soil Taxonomy in the U.S. there should be one criterion for a new subgroup that has to be met before we eve" consider that subgroup. That criterion is that two or more series are recognized, and extensively used in mapping units. These should be taxonomically identified from competing series in the same family by the criteria proposed for the subgroup. This is a double edged proposal In that far too many series descriptions do not quantitatively address competing series and since series are part of the taxonomic system this should not be. If the system works as intended series are the "testing ground" for development of higher categories.

Response to Part (b):
All responses to this were either in agreement, 'no comment' or 'why require two series' rather than one.

Recommendation regarding Part (b):
It is recommended that it be required that these criteria be met by at least two soil series for new subgroups proposed for Soil Taxonomy.

Minority recommendation and comments (b):
A significant minority of the committee is strongly opposed to requiring that two or more series that would classify in a new subgroup be recognized and in use in mapping units before the subgroup can be proposed and considered. The number of series in a potential subgroup does not necessarily reflect it's significance with regard to area, genesis, morphology, etc. For example, a single series may be of major extent and represent more total area than a number of minor series combined. If some restriction of the nature proposed is really necessary, then why not set a minimum requirement with respect to the area represented by the subgroup to be proposed. Throughout the development of Soil Taxonomy and subsequent proposals for major revision (ICOMOX, ICOMERT, ETC.) provision has been made for soils not yet observed or studied. This is particularly true of Suborder and Great Group levels of classification. Implied or postulated subgroups should be proposed and considered only if their actual existance is documented. However, number of series in the proposed subgroup should be of no concern (or a very minor factor) in deciding whether the subgroup is added to Soil Taxonomy.

(c) (The following comment is in response to a" earlier mailing asking for comment on whether a" 'aluminic' diagnostic horizon (or subgroup) is needed for soils having potentially toxic levels of exchangeable aluminum).
I have mixed emotions on the "aluminic" question. A" "allic" family has been used in the ICOMOX classification of Oxisols for the past few years. The Brazilians and other seam to like it and have recognized "allic" phases for the past ten years in their system. However, all the present criteria used to define "allic" use exchangeable Al in one form or another. An absolute amount is less variable with time but less responsive to crop root reaction. Ratios, i.e., base saturation, or Al saturation on a neutral salt CEC base are the best predictors of root response but such ratios

have been altered to at least 1.5M in most of our old fields of Ultisols. Thus, native soil and cultivated soil ca” easily end up

COMMITTEE V: SOIL WATER, SOUTHERN REGIONAL SOIL SURVEY WORK-PLANNING CONFERENCE OF THE NATIONAL COOPERATIVE SOIL SURVEY.

Charge 1: Determine amount of measured soil water table data available in south region and develop guidelines for establishing a soil water data base.

AVAILABILITY OF DATA ON SEASONAL WATER TABLE IN THE SOILS OF THE SOUTHERN STATES

ALABAMA

Unpublished (SCS) data on 11 sites (8 series). Data collected for about 2 1/2 years at intervals of about 2 weeks to 1 month. Onsite descriptions available for a few sites. No redox, 02, Fe, or related data.

2 Ardilla; fine-loamy, siliceous, thermic Fragiaquic Paleudults
2 Dothan; fine-loamy, siliceous, thermic Plinthic Paleudults
1 Eunola; fine-loamy, siliceous, thermic Aquic Hapludults
2 Fuquay; loamy, siliceous, thermic Arenic Plinthic Paleudults
1 Grady; clayey, kaolinitic, thermic Typic Paleaquults
1 Kalmia; fine-loamy over sandy or sandy-skeletal, siliceous, thermic Typic Hapludults
1 Orangeburg; fine-loamy, siliceous, thermic Typic Paleudults
1 Rains; fine-loamy, siliceous. thermic Typic Paleaquults

For information contact George Martin or Glenn Hickman at 205-821-8070.

ARKANSAS

In press (Experiment Station publication) data on 9 sites (3 series) collected for 3 years mostly at 2-week intervals. Onsite descriptions. No redox, 02, Fe or related data.

1 Calhoun; fine-silty, mixed, thermic Typic Glossaqualfs
4 Calloway; fine-silty, mixed, thermic Glossaquic Fragiudalfs
4 Henry; coarse-silty, mixed, thermic Typic Fragiaqualfs

For information contact Charles L. Fultz or E. Moye Rutledge.

FLORIDA

Mostly unpublished (SCSI data, some published in soil surveys. Data collected on about 96 mapping units for 2 to 5 years at about 2-week intervals. Onsite descriptions not available for most sites. No redox, 02, Fe, or related data.

3 Albany; loamy, siliceous, thermic Grossarenic Paleudults
2 Archbold; hyperthenic uncoated Typic Quartzipsamments
1 Basinger; siliceous, hyperthermic Spodic Psammaquents
1 Blanton; loamy, siliceous, thermic Grossarenic Paleudults
1 Captiva; siliceous, hypcrthermic Mollic Psammaquents
2 Centenary; sandy, siliceous, thermic Grossarenic Entic Haplohumods
3 Chipley; thermic coated Aquic Quartzipsamnents
2 EauGallie; sandy, siliceous, hyperthermic Alfic Haplaquods
4 Electra; sandy, siliceous, hyperthermic Arenic Ultic Haplohumods
1 Elgin; sandy, siliceous, thermic Grossarenic Entic Haplohumods
1 Escambia; coarse-loamy, siliceous, thermic Plinthaquic Paleudults
1 Foxworth; thermic coated Typic Quartzipsamnents
1 Garcon; loamy, siliceous, thermic Arenic Hapludults
2 Hurricane; sandy, siliceous, thermic Grossarenic Entic Haplohumods
3 Immokalee; sandy, siliceous, hyperthermic Arenic Haplaquods
1 Jonathan; sandy, siliceous, hyperthenic, ortstein Grossarenic Haplohumods
2 Leefield; loamy, siliceous, thermic Arenic Plinthaquic Paleudults
1 Leon; sandy, siliceous, thermic Aeric Haplaquods
7 Lochloosa; loamy, siliceous, hyperthermic Aquic Arenic Paleudults
1 Lokosee; loamy, siliceous, hyperthermic Grossarenic Ochraqualfs
1 Malabar; loamy, siliceous, hyperthermic Grossarenic Ochraqualfs
2 Malabis; fine-loamy, siliceous, thermic Plinthic Paleudults
1 Mandarin; sandy, siliceous, thermic Typic Haplohumods
2 Mascotte; sandy, siliceous, thermic Ultic Haplaquods
4 Millhopper; loamy, siliceous, hyperthermic Grossarenic Paleudults
2 Myakka; sandy, siliceous, hyperthermic Aeric Haplaquods
1 Narcoossee; sandy, siliceous, hyperthermic Entic Haplohumods
3 Newnan; sandy, siliceous, hyperthermic Ultic Haplohumods
2 Oldsmar; sandy, siliceous, hyperthermic Alfic Arenic Haplaquods
1 Ona; sandy, siliceous, hyperthermic Typic Haplaquods
2 Orsino; hyperthermic uncoated Spodic Quartzipsamnents
1 Ousley; thermic uncoated Aquic Quartzipsamnents
1 Pelham; loamy, siliceous, thermic Arenic Paleaquults
1 Pepper; sandy, siliceous, hyperthermic ortstein Alfic Haplaquods
2 Pineda; loamy, siliceous, hyperthermic Arenic Glossaqualfs
3 Pomello; sandy. siliceous. hyperthermic Arenic Haplohumods
3 Pomona; sandy, siliceous, hyperthermic Ultic Haplaquods
1 Pottsburg; sandy, siliceous, thcrmic Grossarenic Haplaquods
1 Punta; sandy, siliceous, hyperthermic Grossarenic Haplaquods
1 Resota; thermic uncoated Spodic Quartzipsamnents
2 Riviera; loamy, siliceous, hyperthermic Arenic Glossaqualfs
4 Satellite; hyperthermic uncoated Aquic Quartzipsamments
2 Scranton; siliceous, thermic Humaqueptic Psammaquents
1 Smyrna; sandy, siliceous, hyperthermic Aeric Haplaquods
2 Sparr; loamy, siliceous, hyperthermic Grossarenic Paleudults
2 Susquchanna; fine, montmorillonitic. thermic Vertic Paleudalfs
1 Tavares; hyperthermic uncoated Typic Quartripsamments
1 Wabasso; sandy, siliceous, hyperthermic Alfic Haplaquods
3 Wauchula; sandy, siliceous, hyperthermic Ultic Haplaquods
1 Winder; fine-loamy, siliceous, hyperthermic Typic Glossaqualfs
2 Zolfo; sandy, siliceous, hyperthermic Grossarenic Entic Haplohumods

For information contact Wade Hurt or Victor W. Carlisle.

GEORGIA

Unpublished (ARS & SCSI data on 8 series collected for 9 months to 3 years at intervals of 2 days to 3 weeks. Onsite descriptions available (?).

KENTUCKY

Unpublished (SCS) data on 8 soils. Data collected for 1 to 1 1/2 years at intervals of 1 week to 1 month. Onsite descriptions for some sites.

1 Belknap; coarse-silty, mixed, acid, mesic Aeric Fluvaquents
2 Henshaw; fine-silty, mixed, mesic Aquic Hapludalfs
1 Karnak; fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts
1 Latham; clayey, mixed, mesic, Aquic Hapludalfs
1 Lowell; fine, mixed, mesic Typic Hapludalfs
1 Morehead; fine-silty, mixed, mesic Aeric Fluvaquents
1 Newark; fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
1 Stendal; fine-silty, mixed, acid, mesic Aeric Fluvaquents

Published (Univ. thesis) data on 3 soils. Data collected over 1 to 1 1/2 years at intervals of 1 week to 1 month. Onsite descriptions.

1 Huntington; fine-silty, mixed, mesic Fluventic Hapludolls
1 Karnak; fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts
1 Melvin; fine-silty, mixed, nonacid, mesic Typic Fluvaquents

Published (Univ. thesis) data on 5 soils. Data collected over a period of 2 or 3 months.

1 Zanesville; fine-silty, mixed, mesic Typic Fragiudalfs
1 Tilsit; fine-silty, mixed, mesic Typic Fragiudalfs
1 Johnsburg; fine-silty, mixed, mesic Aquic Fragiudults
1 Waverly; coarse-silty, mixed, acid, thermic Typic Fluvaquents
1 Collins; coarse-silty, mixed, acid, thermic Aquic Udifluvents

For information, contact Glenn E. Kelley or A. K. Karathanasis.

LOUISIANA

Unpublished data collected for 6 months (except as noted) at weekly intervals. Onsite descriptions available. No 02, Fe or related data.

1 Anacoco; Vertic Albaqualf: fine, mont., thermic
1 Moreland; Vertic Hapludoll: fine, mixed, thermic
1 Susquehanna; Vertic Paleudalf: fine, mont.. thermic
1 Beauregard; Plinthaquic Paleudult: fine-silty, silic., thermic
1 Sawyer; Aquic Paleudult: fine-silty, silic., thermic
1 Morse; Entic Chromudert: fine, mixed, thermic
1 Roxana; Typic Udifluvent: coarse-silty, mixed, nonacid, thermic
1 Gallion; Typic Hapludalf; fine-silty, mixed, thermic

1 Kisatchie; Typic Hapludalf: fine, mont., thermic
3 Jeanerette[1]; Typic Argiaquoll: fine-silty, mixed, thermic
5 Patoutville[1]; Aeric Ochraqualf: fine-silty, mixed, thermic
1 Frost[1]; Typic Glossaqualf: fine-silty, mixed, thermic
8 Calhoun[2]; Typic Glossaqualf: fine-silty, mixed, thermic
4 ACY2; Aeric Ochraqualf: fine-silty, mixed thermic

Unpublished (Wetlands Lab. for Corp of Engineers1 data on 5 to 10 pedons collected over 2 years at weekly intervals.

For information contact B. J. Miller.

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[1]Data collected for 40 weeks.
[2]Data collected for 60 weeks.

MISSISSIPPI

Unpublished (SCS 8 Univ.) data on 27 pedons (25 series). Will collect for 3 years at monthly intervals. Onsite descriptions. No redox, 02, Fe, or related data.

Unpublished (SCS) data on 3 sites (3 series). Five years data on a monthly interval. No redox, $O_2$, Fe, or related data.

Published (SCS and Mobile District Corps of Engineers) on 13 sites (8 series). Data collected for 1 1/2 to 2 1/2 years at intervals of 1 week to 1 month. Onsite descriptions:

1 Atmore; coarse-loamy, siliceous, thermic Plinthic Paleaquults
1 Harleston; coarse-loamy, siliceous, thermic Aquic Paleudults
1 Benndale; coarse-loamy, siliceous, thermic Typic Paleudults
2 Latonia; coarse-loamy, siliceous, thermic Typic Hapludults
2 Cahaba; fine-loamy, siliceous, thermic Typic Hapludults
1 Columbus; fine-loamy, siliceous, thermic Aquic Hapludults
1 Forestdale; fine, montmorillonitic, thermic Typic Ochraqualfs
1 Askew; fine-silty, mixed, thermic Aquic Hapludalfs
1 Dundee; fine-silty, mixed thermic Aeric Dchraqualfs
1 Catalpa; fine, montmorillonitic, thermic, Fluvaquentic Hapludolls
1 Leeper; fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
2 Mantachie; fine-loamy, siliceous, acid, thermic Aeric Fluvaquents
1 Savannah; fine-loamy, siliceous, thermic Typic Fragiudults
1 Quitman; fine-loamy, siliceous, thermic Aquic Paleudults
1 Una; fine; mixed. acid thermic Typic Haplaquepts
1 Ariel; coarse-silty, mixed, thermic Fluventic Dystrochrepts
1 Guyton; fine-silty, siliceous, thermic Typic Glossaqualfs
1 Ora; fine-loamy, siliceous, thermic Typic Fragiudults
2 Stough; coarse-loamy, siliceous, thermic Fragiaquic Paleudults
1 Wilcox; fine, montmorillonitic, thermic Vertic Hapludalfs
1 Bassficld; coarse-loamy, siliceous, thermic Typic Hapludults
1 Petal; fine-loamy, siliceous, thermic Typic Paleudults
1 Prentiss; coarse-loamy, siliceous, thermic Typic Fragiudults

1 Susquehanna; fine montmorillonitic, thermic Vertic Paleudalfs
1 Trebloc; fine-silty, siliceous, thermic Typic Paleaquults
1 Arkabutla; fine-silty, mixed acid, thermic Aeric Fluvaquents
1 Cascilla; fine-silty, mixed, thermic Fluventic Dystrochrepts
1 Chenneby; fine-silty, mixed, thermic Fluvaquentic Dystrochrepts
1 Gillsburg; coarse-silty mixed, acid, thermic Aeric Fluvaquents
1 Oaklimeter; coarse-silty, mixed, thermic Fluvaquentic Dystrochrepts
2 Tippah; fine-silty, mixed, thermic Aquic Paleudalfs

NORTH CAROLINA

In press (SCS, Soil Suv. Inv. Bul.) data on about 30 sites. Data collected for 1 1/2 to 10 ye.60/x,i-weekly inmetvaltesSome 1

TENNESSEE

Data in dissertation (David Hammer, 1966, Univ. of Tennessee). Observations made monthly for 2 years (Oct. 82 - Dec. 84). Onsite descriptions. Extractable soil Fe and Mn data.

1 Coarse-loamy, mixed, mesic Aquic Dystrochrept
1 Fine-silty, mixed, mesic Aquic Dystrochrept
1 Fine-silty, mixed, mesic Aquic Hapludult
1 Coarse-loamy, mixed, mesic Typic Hapluaquept

For more information contact David Hammer at the Univ. of Missouri.

Unpublished data on 4 series collected for 2 years with variable frequencies of observation, some up to 10 per week. Onsite descriptions. No redox, 02, Fe or related data.

3 Calhoun; fine-silty, mixed, thermic Typic Glossaqualfs
9 Calloway; fine-silty, mixed, thermic Glossaquic Fragiudalfs
48 Grenada; fine-silty, mixed, thermic Glossic Fragiudalfs
2 Loring; fine-silty, mixed, thermic Typic Fragiudalfs

For more information contact Don Tyler at 901-424-1643.

TEXAS

Published data (University thesis) on 8 sites collected for 2 years at l-week intervals. Onsite descriptions with physical and chemical data available. Redox potential measured.

Lufkin; fine, montmorillonitic, thermic Vertic Albaqualfs
Crockett; fine, montmorillonitic, thermic Udertic Paleustalfs
Elmina; clayey, montmorillonitic, thermic Aquic Arenic Hapludalfs
Arol; fine, montmorillonitic, thermic Typic Albaqualfs
Segno; fine-loamy, siliceous, thermic Plinthic Paleudalfs
Splendora; fine-loamy, siliceous, thermic Fragic Glossudalfs
Sorter; coarse-loamy, siliceous, thermic Typic Ochraqualfs
Wallet-; fine-loamy, siliceous, thermic Typic Glossaqualfs

Unpublished data on 5 sites collected for 2 years at 2-week intervals. Onsite descriptions. No redox data.

Oakwood; fine-loamy, siliceous, thermic Plinthic Paleudalfs
Raino; fine-loamy over clayey, siliceous thermic Aquic Glossudalfs
Freestone; fine-loamy, siliceous thermic Glossaquic Paleudalfs
Oerly; fine, montmorillonitic, thermic Typic Glossaqualfs
Mantachie; fine-loamy, siliceous, acid, thermic Aeric Fluvaquents

For more information contact Charles M. Thompson or Larry Wilding.

Regarding the second part of charge 1, "...develop guidelines for establishing a soil water data base," we did not make progress on this portion of the charge. We recommend the next committee give this matter serious consideration.

CHARGE 2: Make specific recommendations on the allowable 02 content or the method of measurement to improve definition of aquic moisture regime.

Response to Charge 2:

We feel that the determination of ferrous iron ($Fe^{++}$) by a,a'-dipyridyl should be strongly considered to serve as a basis for redefining the "reduced" component of the definition of the aquic moisture regime. Our committee, therefore, strongly encourages evaluation of one or more of the a,a'-dipyridyl methods. The method recommended by W. H. Patrick, Jr. (see attachment) appears very promising.

The committee recognizes that our present information about the determination of $Fe^{++}$ with a,a'-dipyridyl is quite limited. The committee also realizes that the requirement for reduction could be deleted from the definition of the aquic moisture regime. If this should occur, we feel that the requirement will be inserted at some lower level within the system of classification.

Workers at the recent workshop on wetlands (Banta, Stephen J. (Ed.), 1985, Wetland Soils: Characterization, and Utilization. Proceedings of a workshop held 26 March to 5 April 1984... Published by the International Rice Research Institute, Los Banos, Laguna. Philippines) recommended the adoption of dipyridyl determination of $Fe^{++}$ for the identification of "wet Andisols" (p. 439). The same group also recommended that the $Fe^{++}$ status should be determined with a,a'-dipyridyl when wetland soils are described (p. 517). Soil scientists in Louisiana and Texas have had some experience with this procedure and encourage additional testing and evaluation.

Basing the "reduced" component of the definition of the aquic moisture regime on the determination of $Fe^{++}$ by a,a'-dipyridyl appears to have the following advantages:

1) Soil morphological features are most frequently an expression of the oxidation status of Fe. Therefore, soil morphology should be more closely related to the presence of $Fe^{++}$ than to the absence of oxygen.

2) The determination of the presence or absence of $Fe^{++}$ in soils by a,a'-dipyridyl is an achievable goal. It is a simple field test which can be made by all soil scientists.

Basing the "reduced" component of the definition of the aquic moisture regime on the determination of the presence or absence of $Fe^{++}$ by a,a'-dipyridyl appears to have the following disadvantages:

1) $Fe^{++}$ appears in reduced soils after the depletion of $O_2$. The time between the disappearance of $O_2$ and the appearance of $Fe^{++}$ is assumed to be a few hours to several days (or even weeks in some cases) depending on the number of microbes present and their activity. Much of this disadvantage can be overcome by reducing the time required that a soil should contain $Fe^{++}$ compared to the time required for a soil to be free of oxygen.

2) a,a'-dipyridyl has some toxicity. (LSD50 for rats and mice is 256 mg/kg orally - Windholz, Martha (Ed.), 1983. The Merch Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Merch & Co., Inc., Rahway, NY. p. 3368). Skin contact and ingestion should be avoided. Plastic gloves should be used in handling the chemical. If it is used as a spray, one should stand downwind and possibly wear a mask.

3) The growth of plants in reduced soils is directly related to the absence of $O_2$ but only indirectly related to the presence of the absence of $Fe^{++}$.

The committee suggests the following questions be evaluated.

1. Should the a,a'-dipyridyl determination be made as a spot plate, spray, or extraction technique or as a combination of one or more of the techniques? The extraction technique is more sensitive for trace quantities of $Fe^{++}$ but required more time.

2. Should the determination be made on ped exteriors, ped interiors, or a mixed representative sample of the soil? If the determination is made on ped exteriors or interiors, what percent should give a positive indication for $Fe^{++}$ before the soil is considered reduced? If peds are required for the determination, what should be done when no peds are present?

3. What are $Fe^{++}$ contents (presence/absence) like with depth below the top of the water table?

4. During which season (fall, winter, or spring) are soils most likely to be reduced?

5. $Fe^{+++}$ in the presence of a,a'-dipyridyl and organic extracts can be photo reduced (is light sensitive). Evidently this doesn't occur for 3 to 10 minutes. Is this a problem? What should be the time limit on evaluating the color?

6. Can the intensity of the red color be correlated with the quantity of the $Fe^{++}$ present?

7. At what depth(s) should reduced soils be required to contain $Fe^{++}$? For what duration? For a continuous period of time or for a cumulative amount of time? Every year or X years out of 10 years?

8. Although essentially all mineral soils should contain some reducible Fe, we will have more confidence in the $Fe^{++}$ evaluation if we can varify that reducible Fe was present in the soil. We therefore should evaluate the use of dithynite-citrate in conjunction with a,a'-dipyridyl for this purpose.

9. The appropriate pH of the a,a'-dipyridyl solution should be evaluated.

10. The literature should be reviewed for the a,a'-dipyridyl determination of Fe++. Wetlands researchers have been utilizing/evaluating this determination for some time.

CHARGE 3: Identify and report on testing of new field methods of identifying aquic moisture regime.

See response to Charge 2.

CHARGE 4: Keep this body informed of proposals and developments of the international committee on soil water.

The International Committee on the Aquic Moisture Regime (ICOMAQ) is essentially in the middle of their deliberations. No proposals have been made and nothing definitive has been decided. I expect some proposals will be made in the next year to year and one-half. Six moisture/morphology conditions, as follow, were recognized in the last communication from the Chairman, J. Bouma:

11 Wet -- reduced & mottled
  1.1 Ground-water gleys
  1.2 Surface-water gleys
    1.2.1 Natural (epiaquic)
    1.2.2 Anthropic (anthraquic)
2) Wet -- reduced & no mottles
3) Wet -- not reduced & no mottles
4) Moist -- not reduced & mottled
5) Moist -- not reduced & no mottles
6) Flooded -- (Evidently "wet" from flooding but no mottles, reduction unclear1

The most important question presently before the committee, in my estimation, is whether to use "saturation with water" or "redox" as definitive at the suborder level. The parameter not chosen will likely be utilized as definitive at a lower level of Taxonomy.

## RECOMMENDATIONS OF THE COMMITTEE

1. The committee should be continued to encourage and coordinate:

   a) Evaluation of a,a'-dipyridyl methods for determining the presence of reduced iron ($Fe^{++}$) in wet soils.

   b) Evaluation of the $Fe^{++}$ status by a,a'-dipyridyl methods of selected soils throughout the south.

   c) Evaluation of the use of a specific a,a'-dipyridyl method as the basis for the "reduced" component of the definition of the aquic moisture regime.

2. Develop improved guidelines for the collection and interpretation of seasonal water table data. This could be done through revision of the "Ground-Water Studies" section of the USDA, SCS Handbook of Soil Survey Field Procedures.

3. Keep the Work Group advised of the activities of the International Committee on Soils with Aquic Moisture Regimes (ICOMAQ).

4. Pursue charges deemed appropriate by the incoming chairman of this Work Group.

COMMITTEE MEMBERS:

C. R. Berdanier, Jr.
C. L. Girdner, Jr.
A. Goodwin
B. Grossman
W. Hudnall
G. Kelley
W. M. Koos
T. C. Mathews
A. L. Newman
B. Parker
D. E. Pettry
O. D. Philen
R. Philips
G. W. Schellentrager
B. A. Touchet
L. B. Ward
R. L. Wilkes
E. M. Rutledge (Chairman)

Attachment No. 1

Louisiana State University
Laboratory of Wetland Soils & Sediments
Center for Wetland Resources
Baton Rouge, LA 70803-7511
(504/388-8810 or 8806)

May 12, 1986

Dr. E. Moye Rutledge
Department of Agronomy
University of Arkansas
Fayetteville, AR 72701

Dear Moye:

I am responding to your recent request for suggestions on the redefinition of the aquic moisture regime. In my work with wetlands, I have been very much involved with considerations of the aquic moisture regime, and I have used soil taxonomy quite a bit in trying to get a handle on what constitutes "hydric soils" and "404 wetlands." If you will give me a call someday, we can discuss various aspects of this problem.

A chemical test I use that is very diagnostic of anaerobic conditions is a test for ferrous iron. Ferrous iron is not formed in the soil as long as any oxygen is present, so its presence indicates anaerobic conditions. I developed a field kit for extracting and analyzing ferrous iron that I have given to a hundred or so EPA, COE and FWS personnel who are involved in determination of wetlands. I am sending you one of these kits, in case you want to try it out.

I'm really snowed this month, so I don't have time to write you in detail with my ideas on the aquic moisture regime, but if you are interested in getting my ideas give me a call.

With best personal regards.

Sincerely,

Wm. H. Patrick, Jr.
Boyd Professor & Director

# FIELD METHOD FOR DETECTING FERROUS IRON IN WETLAND SOILS

## INTRODUCTION

This procedure is a rapid qualitative test for detecting ferrous iron in waterlogged soils. The free iron is extracted with 1 N sodium acetate (pH 2.8) and the ferrous iron can be detected colorimetrically using a,a,-Dipyridyl. Ferrous iron is present when a reddish/pink color appears.

## EXPERIMENTAL PROCEDURE

### Reagents

Reagents included with this kit are .1% a,a,-Dipyridyl solution and 1 N $CH_3COONa$ (sodium acetate) extracting solution. The extracting solution is made by dissolving 82 g $CH_3COONa$ in approximately 900 ml of distilled water, adjusting to pH 2.8 with concentrated HCL, and bringing up to 1000 ml volume. The detection solution is made by dissolving 60 mg of a,a,-Dipyridyl in 60 ml of distilled water. The detection solution included in this kit is viable for about one year. Extra a,a,-Dipyridyl crystals are included.

### Kit Equipment

- One empty 60 ml bottle with screw top
- One empty 20 ml glass vial with screw top
- One five-ml syringe
- One one-ml syringe
- One empty 125 ml wash bottle
- One 250 ml bottle filled with 1 N $CH_3COONa$
- One 60 ml bottle filled with .1% a,a,-Dipyridyl solution
- One 60 ml bottle filled with 60 mg a,a,-Dipyridyl crystals
- Two .45 um Acrodisc filters
- One carrying case

### Specific Procedure

Transfer approximately 5 g of saturated soil into the empty 60 ml bottle and fill the bottle with extracting solution imaediately to prevent oxidation of ferrous iron to the ferric form.

Shake the bottle for about one minute and let the suspension settle out until a clear supernatant is present (approximately 10 minutes).

Take a five ml solution sample from the supernatant with the five ml syringe. Be careful not to disturb the sediment back into solution as this will hamper filtration.

Attach the Acrodisc filter to the end of the syringe and then transfer the sample to the 20 ml glass vial.

Add .5 ml a,a,-Dipyridyl with the one ml syring and mix well.

Reddish-pink color indicates the presence of ferrous iron.

## ADDITIONAL SUPPLIES

Reagents and bottles should be available from any chemical supply house. Most universities have a science supply division that sells to outside customers. The filters are made by Gelman, Ann Arbor, MI 48106 (Product no. 41841. Many of the major companies (Sargent-Welch, American Scientific, etc.) have high minimum orders ($300-$500), however, there may be a local supplier that will order for a nominal charge. Teachers Corner [3225 Lisa Drive, Metairie, LA 70803, phone: (5041455-82431 is one such supplier. Alternative field cases are available from Ben Meadows Company [3589 Broad Street, Atlanta, GA 30366, phone: (800)241-6401].

COMMITTEE VI. “se of soil survey in research and management of forest land

**Chairperson:** Allan E. Tiarks

| | | |
|---|---|---|
| G. Chalfant | D. Manning | J. Ragus |
| D. Eagleston | J. McClinton | R. P. Sims |
| B. Goddard | W. F. Miller | G. Smalley |
| C. Harrington | D. Neat-y | C. Turner |
| G. W. Hurt | J. Keys | J. R. Van” |
| | R. Peters | K. G. Wattersto” |

Charge 1: Explore ways of training foresters on the capabilities of soil survey in forest land management

1. Foresters need to be better trained on using soil surveys so they have a better understanding of the surveys’ uses and interpretations. Attempts to hold training sessions in the past have produced mixed results with some successes while others failed miserably because of lack of interest. Based on this record of past performance, the committee recommends three ways to get good attendance.

A. Include use of soil surveys in training sessions held by organizations such as the SAF or state forestry commissions that have a wider appeal or, in cases such as pesticide certification, mandate attendance.

B. Arrange "i “house” training for industrial land owners and government organizations by convincing higher levels of management that understanding soil surveys will improve their employees’ job performance.

C. Training should be divided into short, multiple sessions so the users have the opportunity to apply soil surveys to their situation during the training period.

2. The committee feels that foresters do not have a good understanding of how soil surveys can be used to improve their performance. Several members felt that improvements to the published soil survey reports could increase their usefulness to foresters. Specific problems are that the interpretations are too vague and not well explained. For example, rating a soil as severe for equipment use does not explain what soil properties cause the limitation, to what equipment the limitations apply, “or how to overcome the limitations. Another suggestion was that the interpretations need to be tied to specific management practices. One solution proposed is to publish supplements to the soil surveys focusing on forestry interpretations.

3. The committee feels that field demonstrations of soil management practices may be useful if tied to other training. But, because establishment and maintenance of such demonstration areas is expensive, field demonstrations would have to be managed by a large organization such as the Forest Service.

4. Members of the committee generally feel that foresters need to have a better concept of map units and how to ***read a map unit*** description. The members have widely differing views on how much soil taxonomy foresters need to know and understand. Some feel that trying to teach soil taxonomy to foresters is unnecessary and increases the difficulty of teaching the proper use of soil interpretations. Other members feel that soil interpretations cannot be efficiently utilized without a basic understanding of soil taxonomy.

Charge 2: Re-evaluate the selection of indicator species published in the SCS National Forestry Manual, and the use of indicator species on the SOIL-5

The primary problem at the present time is the identification of a particular species of tree which represents the ability of a soil (site) to produce wood. Hopefully, the identification and subsequent measurement of an indicator tree species represents the productivity of a soil. We know that the full production of biomass on a soil is not being measured. We hope that the indicator species concept does give a reasonable indication of which soils are the most productive In a basically unaltered state and, in the case of drainage, in a drained condition which is definable.

An indicator species and its productivity, as measured by site index, and related to appropriate yield tables, provides a benchmark for forest managers to gauge their management practices against. Even though size or quality may be more important to some forest managers than rate of growth, most managers use growth as the indication of site quality.

To answer the question about which species should be assigned indicator species status, several criteria are used. The species must be one of the most productive species on the soil, it must be common in the area, and be a species that is commonly being favored in management. Using these criteria, the indicator species is selected on the basis of growth rate, quality, value, and marketability. These standards seem to offer some latitude for personnel who must select indicator species for soils. These indicator species are then placed on SCS-SOILS-5 forms and are used in county soil survey reports.

Problems do occur when trying to assign soils to productivity groups whether the crops are field crops, forage crops, or timber crops. The problems in trying to place forest soils into productivity classes involve difference in aspect, elevation, texture, depth, climate, and so forth. Since the soil and vegetation growing on it reflect the total environmental factors on the site, the dominant vegetation and its growth does indicate the productivity of a soil. Many of the factors influencing vegetation growth cannot be seen in a soil profile and other factors can only be inferred. Of course, a soil mapper does have information, other than just profile descriptions, on which to base a decision; but tree growth is somewhat difficult to estimate, based solely on observation.

If the soil scientist can provide consistently-mapped soils, both forest research personnel and forest managers can gain experience based on observation and test results. This will certainly help in predicting costs and benefits of forest management. Research personnel can design and carry out work on well-defined soil map units so that information can be used in the field. Forest managers can make observations and monitor the results of forest management activities and use this knowledge in planning future activities. Both the researcher and manager should be aware that results may be different on different soils, even though they may appear to be the same or have similar characteristics.

Questions

1. Are the crieria for selection of indicator species sufficient, or do they need improvement?

Several ideas about determining and selecting an indicator species have been suggested. The suggestions seem to agree with some aspects of the current selection process, but do not agree with some other aspects.

One suggestion is to simply use the species that is the most productive on the soil, can be grown in pure stands (80 percent), and occurs naturally on the site. In some cases, the most valuable or desirable species might not be selected for indicator species status, but additional species could be reported on, also. This would assist the forester in selecting species for planting when other management activities, such as wildlife managment, need to be met. Another suggestion is to use groups of indicator species in the many areas where a single species does not seem to be appropriate. The different groups might be used to indicate soil moisture availability classes, regeneration potential, ease of conversion, classes of productivity potential, and shallow and deep phases of a soil map unit or soil series. Using the “group of indicator species” approach may need to have a tighter classification system than the Society of American Foresters Cover Types Handbook, but it appears to be a workable system.

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2. Is it possible to assign indicator species to soil map units across a unit's range as is now attempted, or should we suggest an entirely new approach?

Some soils cover such a wide geographic range that the species of tree selected in one county or state for indicator species status may not even occur in some other county or state. This is not usual, but frequently the species common in one area is not common in another area.

using class determining phases to separate phases of the same soil series that exhibit significant differences in productivity is often used. Phases are most easily defined, or separated, based on soil properties that are fairly easily seen in the field. Differences caused by slope, aspect, elevation, precipitation, erosion, drainage, rainfall or solar-blocking ridges are more difficult to see. Class determining phases, based on these differences have been used, but usually only after significant productivity differences are shown to exist. This is a problem because data gathering usually lags behind soil mapping. Besides missing the opportunity to sample tree growth at the beginning of soil mapping, areas that are found to need a different map unit design may already be mapped. It is difficult to go back and check individual map units for phase criteria, so some soil map units will slip by before it is discovered that different map unit design criteria need to be applied.

Most comments concerning the assigning of an indicator species across a unit's range seemed to indicate that as long as soils are mapped and identified properly, there should be no problem in selecting an indicator species. It was also suggested that the selection of local indicator species for county soil survey manuscripts be selected, as well as one to represent the full range of a soil map unit.

Using class determining phase criteria probably will solve most problems that occur within a Major Land Resource Area (MLRA). However, when soils cross MLRA boundaries, class determining phase criteria is not always useful. Because of the differences in major climatic factors, a new SCS-SOILS-5 form needs to be generated for soils that cross MLRA boundaries. The significant differences in productivity alone should justify this action, without having to develop a new SCS-SOILS-5 form with differing soil characteristics.

Charge 3. Suggest ways to improve coordination of SOIL-5 woodland data with research and field collected data.

1. The committee identified a need to make more specific interpretations to match the interpretations to the foresters needs in surveys where forestry is a major land use. Some data are already available in the reports and only requires editing changes so that the interpretations ace clearly identified to foresters. For example interpretations for engineering uses can be adapted to forestry uses such assuitability for logging landings. The proposed guidelines for use of herbicides for agricultural crops can also be expanded to include forestry herbicides.

2. Some of the interpretations already being made for forestry need to be improved by expanding the use and management sections and by making the interpretations match present forestry practices better. The addition of possible alternatives to management practices when present practices have severe limitations should be encouraged.

3. The committee feels that these problems need to be addressed by concentrating on them at the next meeting.

Recommendations for Change I:

A. Training of foresters should be encouraged through societies, state forestry organizations, and industrial companies.

B. State SCS organizations and cooperators should sponsor training sessions for forestry and other users as new soil surveys are published.

C. The Charge should be retired.

Recommendations for Charge 2:

A. Re-evaluation of the selection of indicator species published in SCS National Forestry Manual, and as used on the Soil-5.

B. If the range of a soil series is greater than the range of an indicator species, investigations should be made to find differences in soil properties to explain the changes in tree growth. If soil properties can be identified that explain the tree response, the series should be split. If not, class determining phases should be established.

Recommendations for Charge 3:

A. The committee identified a need to improve the guidelines relative to soil interpretations for forestland.

B. The committee should continue to w-evaluate present guidelines and to develop new guidelines for these interpretations.

General recommendations: The committee should be continued. Jim Keys, Forest Service, is recommended as the next chairman.

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# NATIONAL COOPERATIVE SOIL SURVEY

## Southern Regional Conference Proceedings

El Paso, Texas
May 20-25, 1984


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Subject: SOI - Proceedings - Southern Regional Technical Work-Planning Conference, May 20-25, 1984

Date: July 18, 1985

To: See addressees

File Code: 430-3

Attached are copies of the Proceedings of subject conference for distribution to participants and Experiment Station Leaders in your State. A few extra copies are available from the Soils Staff, SNTC.

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SOUTHERN REGIONAL TECHNICAL WORK PLANNING CONFERENCE
OF THE
NATIONAL COOPERATIVE SOIL SURVEY

El Peso. Texas
May 20-25, 1984

Held jointly with the Western Region

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SUBJECT: 1984 Southern Regional Technical Work Planning Conference of the National Cooperative Soil Survey.

TO: Recipients of Proceedings

The 1984 session of the Southern Regional Technical Work Planning Conference met in joint session with the Western Regional Technical Work Planning Conference at El Paso, Texas, May 20 to 25. This joint work conference was a first for the National Cooperative Soil Survey. The joint conference offered several advantages to the participants. It provided an opportunity for the participants to exchange thoughts and ideas between the two geographical regions and to participate in a tour of the Desert Geomorphology Project.

The meeting convened at 8:45 a.m. on Monday, May 20 at the Holiday Inn, downtown in El Paso. Joint sessions were held during the day on Monday and again on Tuesday following the committee work sessions. Field trips/or committee meetings were held on Wednesday and Thursday. The meeting was concluded on Friday morning with a joint session following the regional meetings.

Our special thanks and appreciation go to Dr. E.C.A. Runge, Dr. Bill Pope, Dr. Ralph McCracken, Dr. Dick Arnold and to the Directors Representatives, Dr. D. M. Gosset and Dr. J. C. Engibous.

The Committee Chairman and other participants on the program are commended for the time and effort that was expended prior to and during the conference. As a result of the excellent input. the committee reports will provide guidelines and sound recommendations for the National Cooperative Soil Survey for the Southern Region and provide positive input into the National Committees.

Your Co-chairmen appreciated the opportunity to sponsor this activity and hope the delay in the release of this report did not result in any undue problems for you.

The host for the 1986 Conference will be the State of Kentucky. Glen Kelly and Dr. Karathanasis are well underway with their plans.

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Research Director of Agriculture
Tennessee State University
Nashville, TN 37203

6:00 p.m. - Western Hoe Down & Barbeque (Optional - See attached information on tours.)

**Wednesday, May 23**

South Field Trip - Desert Project
Leave Hotel 7:45 a.m.
Return 5:45 p.m.

West - Committee Meetings

6:30 p.m. - 11:30 p.m. - Juarez Fun Night & Dinner (Optional - See attached information on tours.)

**Thursday, May 24**

West Field Trip - Desert Project
Leave Hotel 7:45 a.m.
Return 5:45 p.m.

South - Committee Meetings

**Friday, May 25**

8:00 a.m. - 9:00 a.m. - Business Meeting (Regional)
Joint Session
Joe Nichols and Richard Kover

Committee Reports and Recommendations (10 min. each)

10:00 a.m. - Break

10:20 a.m. - Committee Reports and Recommendations (Continued)

11:30 a.m. - 12:00 Noon - Wrap-up and Adjournment

[redacted]

## Special Activities

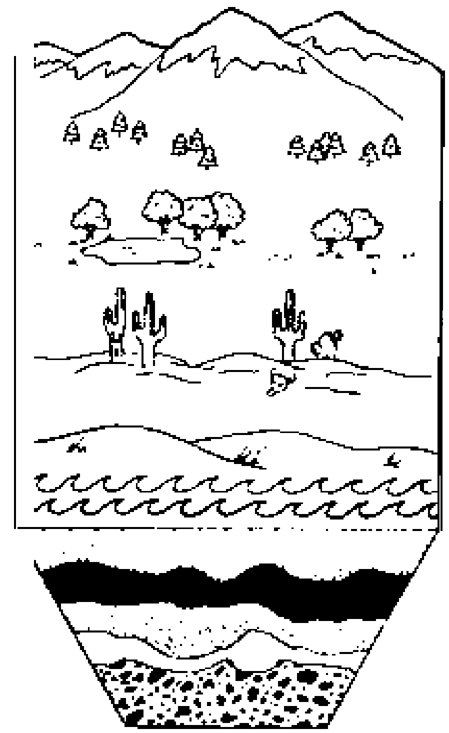
**JUAREZ SHOPPING TOUR AND LUNCHEON**
**Monday May 21, 1984 10 am - 2:30 pm**

**LE MESILLA TOUR AND LUNCHEON**
**Tuesday May 22, 1984 10am - 3:00pm**

**WESTERN HOE DOWN AND BARBEQUE**
**Tuesday May 22, 1984 6pm - 10:00 pm**

**JUAREZ FUN NIGHT AND DINNER**
**Wednesday May 23, 1984 6:30pm - 11:30pm**

# Southern and Western Regional Technical Work Planning Conference of the Cooperative Soil Survey



El Paso, Texas

May 20-25, 1984

## Southern and Western Regional Technical Work Planning Conference of the Cooperative Soil Survey El Paso, Texas

### May 20-25, 1984

**Sunday, May 20**

3:00 p.m. - 5:00 p.m. Registration, Holiday Inn

**Monday, May 21**

**C.M. Thompson, Moderator**

8:00 a.m. - 12:00 Noon Registration

8:45 a.m. - Introductions & Announcements

9:00 a.m. - Opening Comments

Billy Griffin,
State Conservationist,
SCS, Temple, Texas

E.C.A. Runge, Head,
Dept. of Soil & Crop Sciences,
Texas A&M University,
College Station, Texas

Ray Margo,
State Conservationist,
SCS, Albuquerque, New Mexico

L.S. (Bill) Pope,
Dean of College of Agriculture,
New Mexico State University

9:50 a.m. - The Desert Southwest
A Pictorial Overview

10:05 a.m. - Break

10:30 a.m. - Soil Climate & IBSNAT Projects
John Kimble
H. Ikawa

11:00 a.m. - Farmland Protection Policy Act
Howard C. Tankersley

11:30 a.m. - Committee Report from NCSS Steering
Richard Arnold

11:50 a.m. - 12:05 p.m. Northeast Region Report
Ed Ciolkosz

Lunch

**L. P. Wilding, Moderator**

1:15 p.m. - Highlights - The National Scene
Dave Unger

2:00 p.m. - National Resource Perspectives
Ralph J. McCracken

2:30 p.m. - Break

3:00 p.m. - Panel Discussion - Education, Training and Professionalism for Soil Scientists

Richard Arnold, Chairman, Douglas Pease, Allen L. Newman, Cliff Montague.

Charges:

1. Field experience of Graduate Students and course work most useful to soil scientists.
2. Subject areas considered beneficial for employment of soil scientists with Federal agencies.
3. ARCPACS, Publications, etc.

5:30 p.m. - 7:00 p.m. Mixer

**Tuesday, May 22**

8:00 a.m. - Committee Work Groups
Holiday Inn and Public Library

10:00 a.m. - Break

**Gary Muckel, Moderator**

10:30 a.m. - Panel Discussion - Special Investigations

Warren Lynn and Charlie Reynolds, Co-Chairman, David Hendricks, Dave Pettry, William Allardice

Charges:

1. West & South Investigations Projects of joint concern. (20 min. each region)
2. New Methodology (field or laboratory)

11:15 a.m. - Panel Discussion - Quality of Soil Surveys

Ben Hajek, Chairman, Mary Collins, Dick Cline, Herb Huddleston, Fred F. Peterson, R.B. Brown, G.W. Hurt

Charges:

1. Kinds of Soil Surveys with regard to quality.
2. New statistical methods for evaluating the quality of soil surveys.
3. Applicability of geostatistics for survey analyses and pedological studies.
4. Computer Implications

12:00 Noon - Lunch

**LeRoy Daugherty, Moderator**

1:15 p.m. - ICOMERT
Juan Comerma

2:00 pm. - Soil-Range, Team Approach
Ray Miles
Steve Leonard

2:30 p.m. - Break

3:00 p.m. - EPIC Model
Paul Dyke, Westal W. Fuchs

3:45 pm. - 5:00 p.m. Agency Meetings
Dave Pettry, LeRoy Daugherty, Joe D. Nichols, Richard Kover

SOUTHERN & WESTERN REGIONAL TECHNICAL WORK PLANNING CONFERENCE
EL PASO, TEXAS
MAY 20-25, 1984

OPENING COMMENTS

WELCOME TO TEXAS, MORE SPECIFICALLY, WEST TEXAS AND EL PASO FOR THE FIRST JOINT TECHNICAL WORK PLANNING CONFERENCE BETWEEN TWO REGIONS, THIS WORKSHOP SHOULD OFFER SOME UNIQUE ADVANTAGES IN THAT IT WILL PROVIDE AN OPPORTUNITY TO DISCUSS ITEMS OF MUTUAL CONCERN AND TO HAVE AN INTERCHANGE OF IDEAS AND PHILOSOPHIES AMONG THE MANY PARTICIPANTS OF THE NATIONAL COOPERATIVE SOIL SURVEY.

WE ARE PLEASED TO HAVE YOU IN THE STATE, IN A FEW MINUTES YOU WILL SEE A BRIEF SLIDE PRESENTATION THAT WILL DEPICT THIS AREA OF WEST TEXAS AND SOUTHEASTERN NEW MEXICO, I BELIEVE YOU WILL AGREE THAT THIS AREA HAS CONSIDERABLE BEAUTY, IN ITS OWN RIGHT, AND IT ALSO HAS MANY ASPECTS THAT MAKE RESOURCE MANAGEMENT A REAL CHALLENGE, THE ANNUAL RAINFALL HERE AT EL PASO IS JUST UNDER 8 INCHES PER YEAR. RANCHING AND IRRIGATED FARMING ARE THE DOMINANT AGRICULTURAL ENTERPRISES IN THE AREA. FOR THOSE OF YOU THAT HAVE NEVER VISITED THE CHIKUAHUAN DESERT, YOUR VISIT HERE IN EL PASO AS WELL AS THE TRIP TO THE DESERT GEOMORPHOLOGY PROJECT AREA SHOULD GIVE YOU A GOOD INSIGHT INTO THE AREA.

PRESENTED BY BILLY C. GRIFFIN, STATE CONSERVATIONIST, TEMPLE, TX AT THE SOUTHERN 8 WESTERN REGIONAL TECHNICAL WORK PLANNING CONFERENCE AT EL PASO, TEXAS, MAY 20, 1984.

I AM PLEASED TO BE ABLE TO SHARE THESE OPENING COMMENTS WITH MY CONTERPART IN NEW MEXICO AS WELL AS DR. ED RUNGE AND DR. BILL POPE. EL RUNGE REPRESENTS THE SEVERAL NCSS COOPERATORS IN THE STATE WITHIN THE LAND GRANT UNIVERSITY SYSTEM AS WELL AS A NUMBER OF OTHER INSTITUTIONS,

IN TEXAS WE ARE EXTREMELY PROUD OF THE COOPERATION AMONG THE FEDERAL, STATE AND LOCAL ENTITIES AS WELL AS PRIVATE ORGANIZATIONS THAT CONTRIBUTE SUBSTANTIALLY TO THE SOIL SURVEY PROGRAM FOR THE STATE, THIS IS ONLY AS IT MUST BE AND IT CERTAINLY MAKES OUR JOB EASIER AS WELL AS PROVIDING A STRONG BASE FOR THE SOIL SURVEY, I SUPPOSE THAT THE NCSS PROGRAM IS UNIQUE WITHIN OUR SYSTEM OF GOVERNMENT IN THAT IT OPERATES WITHOUT A SPECIFIC MANDATE OR LAW. ITS SUCCESS OR FAILURE RESTS SOLELY ON THE SPIRIT OF COOPERATION AND A DEEP DEDICATION ON THE PART OF THE DIFFERENT AGENCIES OR ENTITIES THAT COMPRISE THE NCSS, THIS DEDICATION CENTERS ON THE NEED FOR MAN TO BETTER UNDERSTAND HIS WORLD AND HOW THE PRECIOUS SOIL RESOURCE CAN BE USED BUT MAINTAINED FOR ALL GENERATIONS.

THIS IS A HIGH CALLING AND ALL OF YOU PRESENT HERE TODAY DESERVE A PART OF THE CREDIT, I KNOW THAT THIS CONFERENCE AND THE RESULTS OF YOUR COMMITTEE WORK AND RECOMMENDATIONS, WILL MOVE US CLOSER TO THAT BETTER UNDERSTANDING THAT WE SEEK.

AGAIN, WELCOME TO TEXAS, IF WE CAN BE OF HELP TO YOU WHILE YOU ARE HERE, CONTACT YOUR CHAIRMAN OR VICE-CHAIRMAN AND I AM SURE THEY WILL TRY THEIR BEST TO ASSIST YOU,

Minutes for the Meeting
of the Southern Regional Soil Survey Work Croup

DATE: May 23, 1984

PLACE: Holiday Inn, El Paso, Texas

PARTICIPANTS: The following were present for the meeting:

H. F. Perkins, Univ. of Georgia
S. W. Buol, North Carolina State Univ.
A. D. Karthanasis, Univ. of Kentucky
Ken Bates, Kentucky Dept. Nat. Resources
Tom Hallmark, Texas A&M Univ.
W. H. Hudnall, Louisiana State Univ.
B. R. Smith, Clemson Univ.
Joe Kleiss, North Carolina State Univ.
Carolyn Olson, U.S. Ceol. Survey WAD Research
Mary E. Collins, Univ. of Florida
V. W. Carlisle, Univ. of Florida
Randy Brown, Univ. of Floride
B. J. Carter, Oklahoma State Univ.
B. L. Allen, Texas Tech Univ.
David 3. Neher, Texas A&i Univ.
Robert D. Baker, Texas A&M Univ.
Kenneth G. Watterston, S. F. Austin State Univ.
B. L. Harris, Texas Agr. Extension Service
B. J. Miller, Louisiana State Univ.
L. P. Wilding, Texas A&M Univ.
Richard Guthrie, Auburn Univ.
D. E. Pettry, Mississippi State Univ.
Frank Miller, Mississippi State Univ.
Ed Ciolkosz, Pennsylvania State Univ.

The meeting was called to order at 3:45 p.m. by D. E. Pettry and W. F. Miller was asked to record the minutes.

The minutes of the 1982 meeting in Orlando, Florida were reviewed with specific attention directed to the section with a committee charge to recommend future action relative to a possible regional project. No action was taken. Discussion indicated there was not sufficient interest in developing a regional project at this time.

Dr. Richard Guthrie presented information concerning activities of Work Groups; a regional project may result from a Work Group, but it is not essential for the functioning of the group.

Dr. Pettry distributed and discussed the results of a questionnaire on soil surveys and teaching activities which had been completed by all the Land Grant University representatives in the region. A copy of the questionnaire and the summary responses is appended. One outgrowth of the ensuing discussion was the question of a group newsletter for information dissemination. The discussion3 indicated a need for more communications, particularly since the group meet3 every two years. Dr. Ed Ciolkosz, who is editor of a newsletter for the Northeastern Regional Work Group, described the situation concerning their newsletter activities. When asked if newsletter items could be included in Soil Survey Horizons (SSH), Dr. Ciolkosz indicated that he felt the SSH was not an appropriate outlet. One reason was the 3-4 month time log in publication. Dr. Cuthrie pointed out that SSH was on a subscription basis and the distribution was perhaps too limited to serve as a general newsletter.

After considerable discussion, Dr. Pettry asked the group to decide on the issue. Dr. Collins presented a motion to establish a Southern Regional Newsletter. During the discussion which followed. Dr. Brian Carter volunteered to serve as initial Newsletter Editor. The motion was seconded and passed unanimously with .the understanding that Dr. Carter would have a "free hand" in developing and formating the Newsletter.

Dr. Carter addressed the group on the subject of research direction after a "once-over" state survey completion. Over-emphasis and misunderstanding on "completion" can have negative effects on research funding for cooperative soil survey work. One need which emerged In discussion was how to best inform and stimulate interest among user groups and administrators. Dr. Wilding addressed the issue of "once-over" mapping by indicating that a survey is never completed, and the soil mapping is but one phase. There is a necessity to recorrelate and/or remap older surveys and to incorporate new information and/or data. The need for additional data to support interpretations was expressed by the group.

The next item of business was the election of Southern Regional representatives to the committee on amendments to Soil Taxonomy. Dr. W. H. Hudnall was elected. to succeed Dr. Tom Hallmark, and Dr. B. R. Smith was elected to fill the vacancy which will be created next year by Dr. B. L. Allen. The committee membership is as follows:

B. L. Allen, Texas Tech Univ., March 1982 - March 1985
D. A. Lietzke, Univ. of Tennessee, March 1983 - March 1986
W. H. Hudnall, Louisiana State Univ., March 1984 - March 1987
B. R. Smith, Clemson Univ., March 1985 - March 1988

The final item of new business was the nomination and election of Dr. B. J. Miller as the Work Croup's representative to serve as liaison with the Northeast Group at their June meeting in Massachusetts.

The meeting adjourned at 5:30 p.m.

Submitted by,

W. F. Miller

AGENDA

SOUTHERN REGIONAL SOIL SURVEY WORK GROUP*

HOLIDAY INN
113 West Missouri
El Paso, Texas

Tuesday, May 22, 1984 - D. E. Pettry, Presiding

3:45-4:00 Report of Research Projects Steering Committee

4:00-4:15 Summary of Questionnaire on Soil Survey and Teaching
D. E. Pettry

4:15-4:30 Research Directions When the Soil Survey is Completed
Brian Carter

4:30-5:00 Discussion

5:00-5:15 Election of Representatives to the Committee on Amendments to Soil Taxonomy

*This meeting is open to Experiment Station and Soil Conservation personnel.

SOUTHERN LAND GRANT UNIVERSITY REPRESENTATIVES RESPONSE
TO QUESTIONNAIRE April, 1984

I. Soil Surveys

A. What percent of your State has the soil survey completed; what is the estimated completion date for the soil survey?

| State | Percent Completed | Estimated Completion Date |
|---|---|---|
| Alabama | 70 | 1995 |
| Arkansas | 90 | 1992 |
| Florida | 60 | 1992 |
| Georgia | 84 | 1996 |
| Kentucky | 70 | 1990 |
| Louisiana | 69 | 1990 |
| Nississippi | 82 | 1996 |
| North Carolina | 51 | 1996 |
| Oklahoma | 95 | 1990 |
| South Carolina | 90 | 1990 |
| Tennessee | 77 | 1990 |
| Texas | 85 | 1995 |

II. Teaching

A. Is a course in soil mapping taught at your institution?

Yes - 4
No -8

1. Do you feel there is a need to offer such a course?

Yes - 4
No -8

B. What has been the trend in enrollment in soil classification during the past 5 years?

Increase 0
Decrease 6
About Same 6

C. What methods do you use to teach Soil Taxonomy?

Hands on experience describing soils from pits identifying diagnostic horizons and keying soil through family level.

Lectures, practical exercises in the laboratory and field.

Lectures using overhead visuals and slides, supplemented by audio tutorial. Laboratories of 60-75 hours on class Field trips to soil provinces of state.

Lecture and writing descriptions and classifying soils using Soil Taxonomy, soil descriptions, soil data.

Lectures, slides, assigned readings, 'take-home exercises and field trips.

Lecture, discussion, field trip format.

D. Do you use SCS personnel as a resource in teaching Soil Taxonomy?

| | |
|---|---|
| Yes | 1 |
| No | 8 |
| Occasionally | 3 |

E. What level of academic support do .you receive to teach courses in soil classification?

| | |
|---|---|
| no support | 1 |
| insufficient support | 4 |
| adequate support | 5 |
| teaching assistants | 2 |

GENERAL

Do you feel a periodic newsletter or other method of communication is needed to keep everyone informed of items of concern?

| | |
|---|---|
| Yes | 8 |
| No | 4 |

May 11, 1984

Report of the Taxonomy Committee

I. The following six proposals were received and all were sent to NHQ with approval recommended on five.

To add Lithic Petrocalcic Calciustolls - sent to NHQ 3/14/83, recommending addition.

To amend Quartzipsamments - sent to NHQ 6/30/83, recommending a change in the determination-size fraction and to change to more than 90 percent resistant minerals for Quartzipsamments.

Shallow Families - sent to NHQ 5/5/83, recommending that soils with petrogypsic or an ortstein horizon within 50 cm be included in shallow families.

To add Arenic Ultic Haplaquods - sent to NHQ 1/25/83. In addition, we recommended that Ultic Haplaquods to be with or without the entic feature. Also, that Alfic Arenic Haplaquods be with or without the entic feature.

To define Typic Troporthods and to add Entic and Aquic subgroups. Letter 2/10/83 recommending further study.

To amend Fragic and Fragiaquic Paleudults - On 1/25/83, we sent a proposal to NHQ to remove all soils that would qualify for plinthic subgroups from Fragic and Fragiaquic subgroups.

These changes are pending approval by the National Soil Taxonomy Committee.

. The following members were elected to the Taxonomy Committee at the Southern Regional Technical Work Planning Conference meeting at El Paso, Texas.

| State Representatives | Federal Representatives |
|---|---|
| Dr. Wayne Hudnall | Wade Hurt |
| Dr. Bill Smith | Larry Ward |

The members of the Southern Regional Soil Taxonomy Comnittee are listed.

| Term Expires at the Work Planning Conference or in May of the Interim years | State Respresentatives | Federal Respresentatives |
|---|---|---|
| 1985 | Dr. B. L. Allen | Don Hallbick |
| 1986 | Dr. David Lietske | Darwin Newton |
| 1987 | Dr. Wayne Hudnall | Wade Hurt |
| 1988 (Term begins in 1985) | Dr. Bill Smith | Larry Ward |

Chairman (as Head of Soils Staff SNTC) Joe D. Nichols

Joe D. Nichols

JOE D. NICHOLS
for the Southern Regional
Taxonomy Committee

SOUTHERN REGIONAL SOIL SURVEY TECHNICAL WORK-PLANNING CONFERENCE

PURPOSE, POLICIES ANU PROCEDURES

1966

I. Purpose of Conference.

The purpose of the Southern Regional Soil Survey Technical Work-Planning Conference is to bring together Southern States representatives of the National Cooperative Soil Survey for discussion of technical and scientific developments. Through the actions of committees and conference discussions, experience is summarized and clarified for the benefit of all; new areas are explored; procedures are proposed; and ideas are exchanged and disseminated. The Conference also functions as a clearing house for recommendations and proposals received from individual members and State conferences for transmittal to the National Cooperative Soil Survey Technical Work-Planning Conference.

II. Membership.

A. Voting Membership.

Voting members of the Conference are the following:
The state soil scientist, or his representative, of each of the 13 States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia) and Puerto Rico.
The experiment station or university soil survey leader, or his representative, of each of the 13 States and Puerto Rico.
The principal soil correlator of the Southern States, or his representative.
One representative of the Soil Survey Laboratory serving the region.
One representative of the Cartographic Unit, SCS, serving the region.
One representative of the Forest Service regional office.
One representative of the Southern Forest Environment Research Council.
(Other organizations designated by the Conference).

R. Non-Voting Membership.

Special invitations may be given to a number of other individuals to participate in specific conferences. Any soil scientist or other technical specialist of any State or Federal agency or private enterprise whose participation would be helpful for particular objectives or projects of the Conference may be invited to attend. These extra participants do not vote on issues of Conference policy and procedure.

III. Officers.

A. Chairman and Vice-Chairman.

A chairman and vice-chairman of the Conference are elected to serve for two-year terms. Elections are held during the biennial business meeting. Election of officers follows the selection of a place for the next meeting, because officers must be from the State where that meeting is to be held. Officers rotate among agencies. That is, the chairman-elect must be of a different agency than the past chairman. Similarly, the vice-chairman must be of a different agency than the chairman.

Responsibilities of the chairman include the following (specific tasks may be delegated to the vice chairman):

1 Planning and management of the biennial Conference.
2. Function as a member of the Steering Committee.
3. Issue announcements and invitations to the Conference.
4. Write the program and have copies prepared and distributed to the membership. Provide a recording secretary to take and prepare minutes of the business meetings of the Conference for inclusion in the proceedings of the Conference.
5. Make necessary arrangements for: food and lodging accommodations for Conference members; special food functions; meeting rooms (including committee rooms); and local transport on official functions.
6. Obtain official clearance for the Conference from SCS and Experiment Station officials, and other organizations as required.
7. Assemble and distribute the Proceedings of the Conference.
8. Provide for appropriate publicity for the Conference.
9. Preside at the business meeting of the Conference.
10. Maintain Conference mailing list, clear membership with appropriate administration, and turn it over to incoming chairman.

Responsibilities of the vice-chairman include the following:

1. Function as a member of the Steering Committee.
2. Act for the chairman in the chairman's absence or disability.
3. Perform duties as assigned by the chairman.

B. Steering Committee.

A steering committee assists in the planning and management of the biennial meetings, including the formulation of committee memberships and selection of committee chairmen and vice-chairmen, organizing the program of the Conference, and selecting presiding chairmen for the various sessions. The Steering Committee consists of the following members, or their designated representatives:

The Conference chairman (Chairman)
The Conference vice-chairman
Principal Soil Correlator, Southern Region
The Conference past chairman and/or vice-chairman

1. Regular Meetings.

At least one meeting is held at each regional work-planning conference. Additional meetings may be scheduled at other times or places if the need arises.

2. Communications.

Most of the Committee's communications will be in writing. Copies of all correspondence between members of the Steering Committee shall be sent to each member of the Committee.

3. Participants.

The Steering Committee makes recommendations to the Conference for extra and special participants in specific regional conferences.

4. Committee Charges.

The Steering Committee is responsible for the formulation and transmittal to Committee chairmen of charges to connlittees.

5. Conference Policies.

The Steering Committee is responsible for the formulation and statements of Conference policy. Final approval of such statements is by vote of the Conference.

6. Liaison.

The Steering Committee is responsibie for maintaining liaison between the regional conference and (a) the Southern Regional Soil Survey Work Group, (b) the Southern experiment station directors, (c) the Southern state conservationists, (d) the national and state offices of the Soil Conservation Service, (e) regional and national offices of the Forest Service, (f) Southern Forest Environment Research Council, and (g) other cooperating and participating agencies.

C. Advisors.

Advisors to the Conference are the SCS State Conservationist and the Experiment Station Director from the state where the Conference is held. In addition other advisors may be selected by the Steering Committee or the Conference.

D. Conittee Chairmen and Vice-Chairmen.

Each Conference committee has a chairman and vice-chairman which are selected by the Steering Committee.

IV. Meetings.

A. Time of Meetings.

The Conference convenes every two years, in even-numbered years. Time of year to be determined by the Conference.

B. Place of Meetings.

The Conference may be held at any suitable location. During the biennial business meeting, invitations from the various states are considered, discussed, and voted upon. A simple majority vote decides the location of the meeting places. Meeting sites should be determined two meetings in advance (eg. 1966 Conference should select place for 1968 and 1970 meetings, and then 1968 Conference select place for 1972, etc.)

C. Separate State and Federal Meetings.

Time is to be provided on the Conference program for separate state and federal meetings if requested by the Conference and scheduled by the Steering Committee.

V. Committees.

A. Most of the technical work of the Conference is accomplished by duly constituted committee.

8. Each committee has a chairman and vice-chairman. A secretary, or recorder, may be selected by the chairman. Committee chairman and vice-chairmen are selected by the Steering Committee. It is the intent, where possible, for the.vice-chairmen to succeed the chairmen at the succeeding conference.

C. The kinds of committees, officers of the conrnittees, and their members, are determined by the Steering Committee. In selecting committee members, the Steering Committee considers expressions of interest filed by the Conference members, but at the same time provides for efficient continuity of work, and considers the technical proficiency of the members of the conference.

D. Each committee shall make a verbal report at the designated time at each biennial Conference. Accepted committee reports shall be written and duplicated by the Committee Chairman as per instructions from the Steering Committee.

Note: Chairmen of Committees are responsible for subtees fe

E. biennialcConferencse.

## COMMITTEE I - METHODS AND USE OF LABORATORY ANALYSES

Committee Membership:

C. T. Hallmark, Chairman
R. Berdanies
Frank Calhoun
Vic Carlisle
Brian Carter
W. L. Cockerham
Robert Griffin
E. N. Hayhurst
R. B. Hinton
Yuch-Ping Hsieh
A. D. Karathanasis
D. E. Lewis, Jr.
Warren Lynn
John Meetze
David Neher
R. Rehner
W. E. Richardson
John Robbins
B. R. Smith

**Charge I.** To formulate suggested methods for computer formatting and cataloging of available laboratory data.

A. Response to Charge I.

The initial action of the committee included development and distribution of a questionnaire designed to obtain current status and projected use of computer stored soil characterization data. Table 1 gives a summary of the status of Southern Region Experiment Stations efforts to maintain computer files of soil characterization data. From the responses, it was evident that continuity in use or format between states is essentially non-existent; further, the uniformity of format over the entire data base within each state is generally lacking with portions of data not stored in files and/or data bases having varying formats. Only Texas reported the coded storage of the pedon description to parallel the laboratory data, although Florida maintains descriptions on word processor files.

TABLE 1. States Reporting Maintenance of Computer Files of Soil Characterization Data.

| State | Computer (file type) | Maintained By |
|---|---|---|
| Alabama | Micro (disk) | Auburn |
| Arkansas | Mainframe (cards) | UA |
| Florida | Mainframe/micro (cards, disk) | UF |
| Louisiana | Micro (disk) | LSU |
| Oklahoma | Mainframe (tape) | OSU |
| South Carolina | Mainframe (cards) | Clemson |
| Texas | Mainframe (disk, tape) | TAMU |

Format for stored data varies within and between states despite the publication of a pedon coding system for the National Cooperative Soil Survey (Thompson, 1979). Lack of acceptance of the pedon coding system is due in large part to excessive use of code numbers and letters and the inclusion of data information not needed or run within the participating experiment station laboratories. Consequently, each experiment station laboratory staff has independently developed formats and software to meet the immediate needs of the laboratory and state. Existence of several different formats and software packages in southern laboratories gives great flexability within the state, but will prove to be a hinderance as efforts are made to utilize data across state lines or collate data sets at regional or national levels. With the use of computer manipulation of data sets, outputs to tape can easily be generated to comply with formats of a data-gathering center at the regional or national levels. An effort centering in the South National Technical Center (SNTC) of SCS has been initiated to collect, format and provide soil characterization data via computer. At this stage data format has not been set. It is imperative that format needs be anticipated in order to design the best storage format for anticipated uses. To do this, R. H. Griffin of the SNTC requests each state and laboratory provide a list of type of data in computer storage (type of analyses) and the procedure used for each analysis. Such information will aid in decisions and design of formats for the National level.

To maximize the usefulness of data sets, development of user-friendly software which utilizes both pedon descriptions and laboratory data is necessary. Our survey indicated such software has not been developed. However, a number of variables were identified as critical for sorting when the user-friendly data management systems are developed. These include, in order of priority, level of soil classification to family, series, diagnostic horizons, geology-parent material, geographic location, landscape position, slope-aspect, CEC-exchange properties, texture, and sample number and pedon indentification number.

B. Recommendations Pertaining to Charge I.

1. In as much as a concerted effort is vital to successfully build a regional and/or national characterization data base and in view of the need and usefulness of such a data base, it is recommended that all states and laboratories support efforts to build a regional/national pedon characterization data system. To this end, each laboratory is encouraged to supply the SCS, Information Resource Management Staff, SNTC, Ft. Worth with a list of procedures used and analyses performed within their laboratory. This will lead to preparation of better format decisions during software development.

2. It is further recommended that the committee remain active and available to respond, aid, supplement, and review efforts of the SNTC as they choose formats and develop software.

**Charge II.** To identify and evaluate new laboratory methods or techniques for characterization of soils, microfabric analysis, and soil mineralogy.

A. Response to Charge II.

An effort was made to identify new techniques for characterization of soils, microfabric analysis and soil mineralogy. Evaluation of each technique was beyond the scope of the committee. Following is a list of new procedures/techniques which were identified. References, when appropriate, are given.

1. Spodic kit . Developed by G. Holmgreen, SCS, NSSL, Lincoln, NE, unpublished. The reports indicate relatively good ability to rapidly identify soil with spodic horizon properties.

2. Bulk density by compliant cavity method. Developed by Bob Grossman, SCS NSSL, Lincoln, NE, unpublished. Reports are favorable when used in freshly tilled soil. Problems have bee" encountered when used in soil with numerous roots.

3. Image analyzers for microspopic analysis. Technique is rather recent and problems exist in its application (Murphy et al, 1977); however, use of circular polarization apparently reduces errors associated with extinction of anisotropic minerals (Ruark, et al. 1982).

4. Scanning electron microscopy, transmission electron microscopy, and microprobe analyses. These techniques are recognized as new and powerful tools for our discipline; however, because of the high technology demands, time required for analysis and associated expense, these procedures will likely remain in the realm of restricted research rather than used in routine characterization programs.

5. Mineralogical composition by combined procedures. During the last few years, development of a more quantitative approach to clay mineralogy by combining individual analytical procedures has received greater attention. Karathanasis and Hajek (1982a) combined x-ray diffraction, x-ray emission spectroscopy, differential scanning calorimetry and thermal gravemetric analysis to quantify the common clay minerals found in southern soils. Further, they also have used water adsorption and water content to differentiate montmorillonitic, mixed, and kaolionitic clay systems, a procedure of promise, especially in developing countries (Karathanasis and Hajek, 1982b).

6. Coefficient of linear extensibility by thermomechanical analysis. An alternate, rapid procedure for determination of COLE has been developed (Hajek, 1979) but because of special equipment requirements for the procedure, wide use of the procedure is unlikely.

7. Rapid procedure for determination of calcium carbonate equivalent. A routine procedure for rapid determination of soil carbonates has been developed (Loeppert, et. al, 1984). The procedure uses the change in pH that results when acetic acid

reacts with calcite for quantification; the technique has wide application ranging from field techniques (portable pH meter) to soil testing laboratories.

8. Rapid removal of gypsum and carbonates. In preparation of gypsiferous samples for particle size distribution or clay separation, it is commonly necessary to remove gypsum. A rapid method to accomplish gypsum removal utilizing heat treatment has been recently developed (Rivers, etal. 1982). Further, a more rapid method to remove carbonates from highly calcareous material using Na-acetone, pH 4.5, has been presented (Rabenhorst and Wilding, 1984).

9. Determination of particle size distribution in gypsiferous soil. A new technique using barium chloride has been described for determination of particle size in gypsiferous soil (Hesse, 1976); at present, the procedure has not received extensive testing but merits further study.

B. Recommendations Pertaining to Charge II.

No recommendations were made relative to this charge.

Charge III. To identify and evaluate methods or techniques of soil characterization applicable to field party laboratories.

A. Response to Charge III.

In order to identify procedures commonly used in field party laboratories and to indicate states with experience relative to each field analysis, the survey response is presented in Table 2.

Table 2. Analyses performed in field laboratories in the Southern Region.

| Analyses | States with experience in analysis |
|---|---|
| Hatch kit (BS,CEC) | Al, Ar, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX |
| Particle size (hydrometer) | FL, LA, MS, NC, SC, TN, TX |
| Portable pH meter | AL, AR, FL, GA, KY, NC, OK, TN, TX |
| Calcium carbonate | FL, TX |
| COLE | LA, OK, TX |
| Salinity | OK, TX |
| Clay-sized carbonates | TX |
| Dialysis for PSD | TX |
| Spodic test kit | FL |
| Reduced Fe | LA, TX |
| Exchangeable Al | LA |

It is beyond the scope of this committee to present all possible field procedures that can be utilized in field laboratories. For additional aid, state personnel can be contacted for opinions on usefulness and appropriateness of procedures they have used. However, a number of procedures with references are presented. Reference to brand names on manufacturers does not constitute endorsement of the product.

1. Hatch kit. All states indicate experience with these kits for CEC and base saturation.

2. Particle size distribution by hydrometer. Although numerous methods are avai lable, the procedure by Day (1965) remains one of the most accurate.

3. Calcium carbonate equivalent. Two methods are available that are easily performed in field laboratories (Holmgren, 1973; Loeppert, et al. 1984).

4. Coefficient of linear extensibility. Although a number of procedures have been used in the field for estimation of COLE, few have been documented and published. The reader is referred to Schafer and Singer (1976) for a rapid and sufficient procedure that must be correlated with laboratory COLE for the survey area.

5. Clay-sized carbonates. This procedure combines clay fractionation with calcium carbonate equivalent to aid field soil scientists in decisions of family mineralogy and particle size classes (Gabriel, et al 1984).

6. Dialysis for PSD. Removal of soluble salts and gypsum, when necessary, is accomplished prior to hydrometer PSD analysis (Rivers, et al. 1982).

7. Spodic test kit. See Charge II.

8. Reduced Fe. Testing for reduced (ferrous) forms of iron has been accomplished using $\alpha,\alpha$-dipyridil (Childs, 1981). Further testing is needed to adequately interpretate negative results.

9. Exchangeable Al. A field procedure to quantify the amount of exchangeable Al has been developed and could be combined with CEC (Hatch kit) to estimate % Al saturation and lime recommendations.

It should be noted that field laboratories are not want to replace Soil Characterization Laboratories. Field lab results should be correlated with and checked against standard samples to insure adequate accuracy.

B. Recommendations pertaining to Charge III.

No recommendations were made relative to this charge. States and field personnel are encouraged to utilize available procedures in field laboratories to expand their data base for survey areas.

General Recommendation.

Continuation of this committee is recommended. Further, two primary charges are suggested. First, as discussed under Charge I, the committee should be used as a sounding board to respond, aid, supplement, and review efforts of the SNTC as formats are chose" and software developed for data. Second, the committee should be charged with selection of soil samples, and distriation of the samples to laboratories in the southern region with the objective of determining variability within and between laboratories for common procedures.

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## COMMITTEE 2 - QUALITY OF SOIL SURVEY

Chairman: G. Wade Hurt

Members:

| | | |
|---|---|---|
| Fred Beinroth | Ben Hajek | Dave Lietzke |
| Earl Blakley | D. C. Hallbick | Arnold Molina |
| Bobby Birdwell | Berman Hudson | Allen Newman |
| Randy Brown | Bob Johnson | Dave Pettry |
| Mary Collins | Glen Kelley | Carter Steers |
| J. A. Doolittle | John Kimble | Dan Upchurch |
| Talbert Gerald | Gaylon Lane | John Vann |

Charges:

(a) Identify computer programs that are applicable for use with micro-computers for determining soil variability.

(b) Discuss applicability of geostatistics for soil survey analysis and pedological studies.

(c) Case examples cf quality control procedures used in defining map unit composition.

Charge (a): Identify computer programs that are applicable for use with micro-computers for determining the following:

1. Map Unit Variability:

| Computer Type | Program Source | Alternate Source |
|---|---|---|
| IBM-XT(PC) | SNTC | Florida SCS Soils Staff |
| Radio Shack TRS-Mod 12 | SNTC | |
| TI-994A | SNTC | Texas SCS Soils Staff |
| Radio Shack TRS 80-PC1 | SNTC | Alabama SCS Soils Staff 1/ |
| Apple II | James Brown<br>P. 0. Box 761<br>Auburn, AL 36831-0761 | |

1/ 8. F. Hajek, Auburn University, has developed additional programs for analysis of data for the TRS 80-PC1.

2. Pedon Variability:

| Computer Type | Program Source | Alternate Source |
| --- | --- | --- |
| IBM, Mainframe 3031 | Dept. of Plant & Soil Science, Univ. of Tennessee | |
| AMDAHL 470 Mainframe | USGS (Kriging) | Soil Science Dept., Univ. of Florida |
| Apple II | Soil Science Dept., Univ. of Florida | |
| Most Mainframe (Basic and Fortran) 2/ | USDA-ARS, Texas Tech. University | |

The computers and program sources listed above are examples only and their listing does not constitute endorsement of any particular system. Those programs developed for map unit variability mostly used t-distribution, others are available for binomial distribution, and F distribution. All NCSS universities and most federal cooperators have either micro, mini, or mainframe computers available. These computers are capable of determining pedon variability for any pedon characteristic.

2/ Contact Dan Upchurch for programs using 1 dimensional variogram, 2 dimensional variogram, 3 dimensional variogram, directional variogram, all directional variogram, unique neighborhood kriging, and gliding neighborhood kriging.

Charge (b): Discuss applicability of geostatistics for soil survey analysis and pedological studies.

Through the use of semi-variograms and the "kriging" method of extrapolation, geostatistics is adaptable to the analysis of map unit variability and pedon variability as a function of distance. This method can be used to select

Yost, R. S., Uehara, G., and Fox, R. L., 1982. Geostatistical analysis of soil chemical properties of large land areas. II. Kriging. Soil Sci. Soc. Am. J., 46:1033-1037.

There are two distinct disadvantages:

1. By using semi-variograms and kriging, normally only one variable (isarithmic) can be determined. If more than one variable is to be determined, the more difficult method of autocorrelation or cokriging must be used. Programming is costly and time consuming.

2. Although statistical treatment of geosurfaces have been used for pedological studies, the studies have been, in the most part, research orientated and published in scientific journals not normally available to field soil scientists.

Charge (cl: Cite examples of quality control procedures used in defining map unit composition.

The Alabama SCS Soil Staff responded with a systematic approach to determining map unit composition and consistency (attachment 1). The publication "Guidelines for Evaluating the Adequacy of Soil Resource Inventory" (Forbes, Rossiter, and Van Wambeke, 1982), gives examples of determining most types of map unit, soil pedon, and soil survey equipment (map, etc.) variables. This publication is available through the Program Leader, SMSS, SCS, P. 0. Box 2890, Washington, O.C. 20013-2890.

Recommendation for Charge (a): Programs have been developed and are available for use. This committee recommends that all states obtain and utilize a computer aided method for determining map unit and pedon variability.

Recommendation for Charge (b): Geostatistics is applicable to soil survey and pedon analysis. This committee recommends that all pedologists, particularly those in leadership positions, become more familiar with this method of statistical treatment of geosurfaces and develop guidelines for its use.

Recommendation for Charge (c): Quality control procedures for defining map unit composition are available. This committee recommends that all states develop and utilize a method for defining map unit composition.

General Recommendation: This committee recommends that this committee be discontinued.

Attachment 1

NSH

This supplement outlines procedures for determining map unit composition and consistency and provides for verification of map unit composition and consistency for all map units of all Progress Soil Surveys in Alabama.

--Soil delineations are made by the normal landscape feature(s) identification and photo interpretations in accord with survey design. All delineations are investigated and projections are checked by onsite investigations.

--As a part of surveying and investigation, potential transects which in the party leader's judgement represents each specific delineation are located. These transects are distributed evenly throughout each map unit's delineations. One potential transect is located for each 400 to 700 acres. Minor map units are represented by smaller delineations. Transects are usually located at right anples to drainage patterns, include as much of the complete range in elevation as possible, and represents the typical landscape for the map unit.

--Prior to completion of 20 percent of the expected extent of a map unit, three transects are randomly selected and data are collected from each. Each map unit regardless of the expected number of named taxons is transected by a point intercept method.

--Data are collected from the selected transects and recorded on a Soil Transect Data Sheet **(AL-SOI-1).** Between 10 and 20 equally spaced observations are made along each transect. Each observation is classified to the series level. Transects are summarized below:

Hap Unit 28

| Series | Transect Number | | |
|---|---|---|---|
| | T-15-1 | T-62-3 | T-15-7 |
| Alpha | 60% | 60% | 70% |
| Beta Variant | 20% | 30% | 20% |
| Gamma | 10% | 0% | 10% |
| Other | 10% | 10% | |

These data are available prior to the addition of a map unit to the Soil Identification Legend.

During a field visit or field review the data are statistically analyzed. At an 80 percent to 95 percent confidence level the arithmetic mean, number of transects needed, and the confidence level are determined. The confidence level will depend upon the expected use of each map unit and is determined by the State Soil Scientist. A schedule for obtaining additional data is agreed upon during the exit conference of the field visit or review. Map units inconsistent in soil composition will be redesigned.

--The review leader designates and participates in the collection of data at least one transect during each field visit and/or progress review.

--All transect data are analyzed after the soil survey is 80 percent completed. Data from transects needed at the desired confidence level are collected prior to the completion of the survey. Data used for correlation documentation has a coefficient of variation of 30 percent or less.

--All transect data and statistical analysis are used for describing each map unit and becomes a part of the correlation documentation.

Committee 3. Soil Survey Interpretations

Charge 1. Identify methods of recorrelation in areas such as MLRA's or multi-county areas where published surveys are available and in need of updating soil interpretations.

Present experience on regional or MLRA recorrelation of older surveys is limited. This approach to the updating of existing soil surveys seems to offer several advantages. Such a method would be more efficient and would provide an important step toward achieving a uniform national soil resource data base that would integrate with other National Resource Inventory (NRI) efforts and future activities of the Resources Conservation Act (RCA). It would also seem that the existence of a totally integrated and uniform soil data base may be a requisite for gaining the political support for a future generation of soil survey activities.

It is, however, equally certain that soil surveys serve more than base-line data for nationwide plannersandpolicy makers. First and foremost soil surveys are to serve the needs of local land owners, managers and decision makers. If this has been the major goal of the soil survey thentheprinciple role of recorrelationinthe updating process should be to better serve the needs of the specific survey area. Primary emphasis should be placed on improving local interpretations fine-tuned to user groups in the county. Caution is urged with respect to any efforts that are so broad in scope as to compromise local needs or de-emphasize the focus on local user input. It would seem that the recorrelation and updating process should be designed to fulfull the unique interpretive requirements of a county. Is this goal compatible with a regional approach to updating?

It is suggested that the "Soil Survey Evaluation Worksheet", that has been formulated as a tool for determining update needs and justification, provides a uniform means of evaluating recorrelation needs. This worksheet or some similar detailed evaluation approach if fully and quantitatively completed with assistance from specific local user groups should provide guidance and answers to many of the initial recorrelation and update questions. A rigorous, objective, quantitative assessment and thorough evaluation of this type should certainly be undertaken before any priority or updating can be developed.

Such an evaluation will likely reveal that not all counties in a region or MLRA will have the same priority for being updated. Each survey has its own character, problems and needs. Recent emphasis of the soil survey program has been placed on localization, individualization and innovation to improve utility of a survey report. The date of completion of individual surveys will reflect varying stages of correlation decisions and the state of soil knowledge at a given time. MLRA's could encompass a wide range of survey dates.

Given the foregoing concerns this committee has not identified particular methods or approaches for multi-county recorrelation. It appears that the approach will vary with the needs and problems in each area and should remain flexible. As more experience is gained guidelines can become more definitive.

This committee recommends that the needs of the individual county be given highest priority in any updating process. The NCSS must continue to strive for efficient coordination among states and regions as we move toward the goal of a correlated national soil resource data base. We must however maintain clarity of goals and not let attempts to achieve more detailed, sophisticated interpretations for specific users be diluted by the desire to satisfy a broad national planning inventory.

Charge 2. Recommend formating for soil interpretations in updating of older surveys.

Completion of an objective quantitative assessment of an older survey to include a rigorous review of user needs should clarify the objectives of an interpretive update. Each survey will be different and have different needs. Old surveys will have a "track record" that should illustrate specific updating concerns. Advantage should be taken of this experience to strengthen grass roots user support of the NCSS by focusing in more detail on certain interpretations.

The updating process affords an opportunity for renewed educational and promotional efforts to expand use and support of soil survey data. Should we produce an updated survey document that is quite simular in standard format to the existing one that is now old hat and perhaps starting to gather dust or should we be innovative rather than standardized?

A great deal of interest in soil survey could be generated with a strong user focused educational effort designed not only to promote the soil survey but to establish productive input. This "campaign" could provide the springboard for determining the most appropriate form of update document. While such a program may slow the progress and process of updating it should create an environment for the transition into the "basic soil services" concept. It would seem only where a strong demand for soil information has been generated can the future "basic soil services" approach be successful. The updating process seems an ideal opportunity for gaining a great deal of grass roots support for the NCSS.

Other factors certainly have a bearing on the updating process and formating as well. Not the least of which is the potential for computerization with digitization such that the need for a hard copy of a soil survey report may be diminished.

Rather than recommend a specific format for soil interpretations in updating older surveys this committee urges innovation to further stimulate user application and to expand utilization of soil survey data with the goal toward increased support for the National Cooperative Soil Survey. While this may slow the process the dividends may be significant.

Charge 3. Current research needs to identify soil erosion impacts on crop yields.

With the increasing pressure for understanding the relationships of erosion and yield loss and for prediction models our soil survey data will receive greater scrutiny as the authoritative soil resource inventory. Numerous modeling efforts are in various stages of development and have shown their potential for making dramatic long term predictions. As these models become increasingly complex they also tend to magnify any gap in our basic understanding of erosion, soil properties and landscape relationships (i.e. a soil mapping concern). Many of these modeling efforts that begin with a local or regional focus suddenly are extrapolated to contrasting soils, landscapes and climatic regions. The Cooperative Soil Survey has the expertise and responsibility to share our understanding of soil and landscape characteristics. More specifically we must portray the complexity and help to negate the hazards of oversimplification of the soil continuum.

With our soil genesis prespective we must urge caution in the assumptions being made about the amount of original topsoil upon which correlations of topsoil loss and loss of productivity are based. These assumptions are often soil, landscape, crop and climate dependent. Some recent studies have shown yield losses due to erosion are related to chemical properties and fertility status. Other studies suggest minor chemical effects but rather stress changes in physical properties with main emphasis on water holding and infiltration as the major factors contributing to yield reduction.

Of the many studies on the effects of erosion on yield few have considered the soil in its natural landscape setting with all the complexities that lie therein. Predicting yields on a so-called eroded soil without knowledge of the erosion class - landscape position interactions is not recognizing important soil-landscape relationships.

Recent work in the North Carolina Piedmont has documented the difficulty in separating the effects of historical soil erosion and landscape position on corn yield. The data indicates that the soil moisture regime is clearly related to landscape position and that variation in plant available water among landscape positions contributes to the observed yield differences in a given field of eroded Cecil (clayey, kaolinitic, thermic Typic Hapludult). Head and footslope positions (converging water flow) usually yielded more than crest, shoulder and linear slope positions (diverging flow). At the same time it is not uncommon to find slightly, moderately and severely eroded soils on the same topographic position within a soil map unit delineation. Inches of topsoil loss is much too simplistic and certainly does not establish the proper relationship with crop yields.

It is clear that the factors affecting crop yield at a given landscape position include more than just the erosion class. Research is needed on determining the specific soil properties that actually cause yield changes when a soil is subjected to accelerated. Is it loss in infiltration, water holding capacity, crusting-seedling emergence, pH and low fertility of the subsoil or what? It should be obvious to us in genesis and classification that the reason and the magnitude of the effects will vary with soil, crop, climate, management inputs and landscape position of the soil. If we are to move forward with management recommendations including conservation practices we must know the specific agents responsible for any yield changes. We can only manage soil properties not concepts of erosion. Management for reducing soil loss alone without knowledge of specific factors involved in actual yield relationships does not move us forward a great deal with our clientele.

Since soil survey deals with the distribution of soil properties across the landscape, NCSS should take a more active role in unraveling erosion-yield relationships. We should encourage the use of the SOI-1 form for soil crop yield data. Improved yield data on a range of soil conditions can assist in focusing researchers attention on all soil-landscape interactions that affect yield. The NCSS must then communicate this information in mapping units and interpretations. If we don't provide a solid scientific basis for productivity predictions someone less knowledgeable certainly will.

The complexity of erosion class-landscape position-yield creates even more concern for the Cooperative Soil Survey as we endeavor to design and describe mapping units. Recent measurements have revealed scales as intense as 1:2000 would be necessary to delineate the important topsoil differences attributed to erosion. Users of maps and those making modeling predictions must realize that within a soil map unit delineation yield variability may range from 50 to 150 percent of the mean. The yield variability is in large part a landscape position-erosion class interaction. As we in the Cooperative Soil Survey define and portray landscape characteristics and place yield ratings on various soil conditions, we must do so with full insight into the cause and effect relationships. It will indeed be a challenge to communicate this information where mapping scales are at 1:24,000.

General committee recommendations:

The committee recommends that future conferences continue to address update mechanisms and strategies and share their individual experiences. A number of states have or are now moving into the mapping completion phase and will have much to share with states that are several years away from a major updating effort. We encourage innovation as part of a renewed and priority effort of promoting the NCSS.

H. J. Kleiss* (Chairman)
G. Acevedo*
J. F. Brasfield
George Buntley
Bobby Carlile
Everette Cole*
Ray Daniels
J. L. Driessen
R. T. Fielder
Andy Goodwin

B. L. Harris*
Dan Manning
Calvin Mutchler
J. A. Phillips
Ray Sims
B. J. Wagner
Bill Waite
DeWayne Williams
Jack Williams*

*In attendance at El Paso Conference

COMMITTEE IV
DIAGNOSTIC HORIZONS

Southern Regional Technical Work-Planning
Conference of the National Cooperative Soil Survey

Members of Committee IV:

| | |
|---|---|
| B.L. Allen, Chairman | A. Hyde |
| L.C. Brockman | W.M. Koos |
| S.W. Buol | J.D. Nichols |
| J.W. Frie | H.F. Perkins |
| C.L. Fultz | I. Ratcliff |
| C.L. Girdner, Jr. | W.I. Smith |
| C.W. Hail | C.R. Stahnke |
| E.N. Hayhurst | R.L. Wilkes |
| W.H. Hudnall | |

Committee Charges:

(a) Is a modification of the definition of a calcic horizon needed?
(b) Should the thickness requirements of the petrocalcic be re-evaluated?
(c) Should the natric horizon in the presence of gypsum and/or with high exchangeable aluminum contents be revised?
(d) Identify concerns in application of new horizon desiqnations. Recommend the optimum number of subscript symbols to be used on a horizon. Should subscripts be used on transition horizons?

Introduction:

Much of the Committee's work was done by mail prior to the meetinq. A request was mailed to each member asking them to reply specifically to one or more charges. At the same time, they were invited to respond to any of the other charges besides the specific one(s) to which they were asked to reply if they desired. A good response to the request was obtained.

Discussions of each of the four charges, together with the responses obtained by correspondence, were held with each of the four discussion groups in El Paso. An additional meeting was called for late May 24 to further discuss some of the points brought out (and questions raised) in the discussion groups. A report was given to the general session (combined Southern and Western Groups).

Action Taken:

<u>Charge A (Calcic Horizons)</u>

The general feeling was that the definition of the calcic horizon is allright except for the thickness requirement in shallow families. It was recommended that the Field Specialist-Soils having the problem with the present definition propose the needed changes along with examples of soils that would be affected. (See attachment for suggested changes, with some minor editing on my part, from C.L. Girdner, Field Specialist-Soils, Texas.)

Charge B (Thickness Requirement of Petrocalcic Horizons)

The proposal was made and approved that the present combined thickness-percent (cm-%) requirement of the horizon be dropped. Instead, it was proposed that the requirement be a thickness of at least 1 cm (0.4 inches) with a stipulation that the cementing material be dominantly calcium carbonate. It was mentioned during the discussion that a l-cm thick horizon and a thicker one could have different implications for engineering interpretations. However, it was emphasized that the thinner horizon would be just as effective in deterring root penetration. It was recommended that the continuity requirement for petrocalcic horizons be reworded similar to that of lithic and paralithic contacts, i.e. the average horizontal spacing of cracks should be at least 10 cm. It was mentioned that field soil scientists in Texas (and Texas has almost all the soils with petrocalcic horizons in the Southern Region) have not been following the continuity requirement as it is now worded. (See attachment for suggested changes, with some minor editing on my part, from C.L. Girdner, Field Specialist-Soils, Texas.)

Charge C (Natric Horizons)

The original charge included two implied facets: (1) What is the influence of gypsum and (2) is the present definition adequate when significant quantities of exchangeable aluminum are present.

In the course of the discussions, still a third problem was identified: How should horizons with the field morphology of a natric horizon and accompanying slow permability, but which do not meet the present chemical criteria, be handled.

In one of the discussion groups it was recommended that the definition be left as it is presently worded and that the problem be resolved at the series level, or possibly with new subgroups, e.g. "solodic" as proposed by Louisiana.

In the final discussion the aforementioned proposal was rescinded and a new recommendation was made that a new Southern Regional committee be established prior to the next Work Planning Conference to study the problem more in depth.

Charge IV ("New" Horizon Symbols)

Major concerns expressed in pre-meeting correspondence and in the discussion groups: (1) lack of uniformity in the manner in which many of the symbols are being applied, (2) the possible establishment of lower limit criteria, e.g. the volume percentage of plinthite for the use of the "v" symbol, and (3) the number of lower case symbols that should be used for any one horizon,

Despite considerable support for lower limit criteria establishment, it was emphasized by some committee members (and visitors) that quantification of horizon features (or components) should only be attempted for diagnostic horizons (or features) and that the significance of a feature, i.e. whether a symbol denoting its presence should be used, should be the decision of the field soil scientist. The final recommendation was that one of the major charges of the Committee, assuming that it is continued, be to investigate the feasibility of establishing minimum requirements for using the lower case symbols.

Additional recommendations of the Committee were: (1) no limit on the maximum number of lower case symbols that can be used for an individual horizon, (2) establish a symbol to denote the presence of slickensides, and (3) to not restrict the use of lower case symbols for transitional horizons when deemed appropriate.

Two discussion groups and those present at the final committee meeting discussed the desirability of using lower case symbols with a "Bw". Both pros and cons for the use of additional symbols were expressed. No concrete proposal was made.

The general recommendation was made that more and "better" examples of the new symbol use, in addition to those in Chapter IV of the Soil Survey Manual, should be distributed. It was specifically recommended that the use of the prime, especially in a sequence of buried soils, should be clarified with examples.

Continuance of the Committee: It was recommended that the Committee be continued and that the Committee be continued and that one or more, perhaps several, of the present committee members be retained for continuity.

B.L. Allen: Chairman
Committee IV

## Calcic Horizon and k Horizon

The calcic horizon is a horizon of accumulation of calcium carbonate or of calcium and magnesium carbonate. The accumulation may be in the C horizon, but it may also be in a variety of other horizons such as a mollic epipedon, an drgillic or a natric horizon, or a duripan, or a C horizon.

The calcic horizon has two form?. In one, the underlying materials have less carbonate than the calcic horizon. This form of calcic horizon includes content ($CaCO_3$ equivalent) of a layer 15 cm or more thick exceeds 15 percent by weight and the layer has at least 5 percent more $CaCO_3$ equivalent than the next underlying layer.[1]

The genetic implications of a calcic horizon are variable. In arid regions, if the parent materials contain considerable amounts of calcium, the very limited rainfall seems not enough to remove lime completely from even the surface soil to a depth of a few centimeters. About the only significant horizon that can develop in such a soil is a calcic horizon. Pedon 36 illustrates such a situation. In this soil, the calcic horizon extends from a depth of 10 to 58 cm.

On the steppes, an A horizon or mollic epipedon may develop in addition to a calcic horizon. Apparently, no other horizons ordinarily develop. Pedon 37 illustrates such a soil The mollic epipedon is 38 cm thick, and it rests on a calcic horizon that extends to a depth of 145 cm.

Some soils in semiarid regions have a calcic horizon above and in an argillic horizon. It is presumed that the argillic horizon developed under a climate wetter than the present one. These soils are receiving carbonates from aeolian sources, and a calcic horizon is now forming at a relatively shallow depth. In such situations, the calcic horizon is presumed to start where the identifiable secondary carbonates amount to >5 percent by volume, and the $CaCO_3$ equivalent exceeds 15 percent.

In soils that have, near the surface, ground water that contains an appreciable amount of calcium bicarbonate, the capillary rise and the evaporation plus transpiration cause precipitation of a large amount of lime. Depending on the depth from the surface to the capillary fringe, lime may be deposited at the surface or in the soil at a depth of about 30 to 60 cm. In such soils, the accumulation of lime is comparable to the accumulation of more soluble salts in desert playas. Pedon 38 is a soil that has such a calcic horizon in the upper 46 cm of the soil. The calcic horizon of this soil is also a mollic epipedon. Depending on the position of the water table, such soils may occupy depressions. If water was ponded, a soil that has a calcic horizon forms a circular outline around the deeper depressions and also occurs on micro elevations in the depressions.

In the situations just discussed, one might attach a high genetic significance to a calcic horizon. In some other circumstances, however, one can attach little genetic significance to the absolute amount of carbonates in a horizon or layer of carbonate accumulation. Deposition from ground water at a depth of 3 m or more is more nearly a geologic than a pedologic process. In soils formed from calcareous materials on the steppes, the amount of lime in horizons that contain secondary lime is a partial function of the amount of lime in the parent materials. One might consider the presence or absence of a k horizon to be significant at some categorical level, but one might not be concerned at any categorical level with the absolute amount that makes the distinction between a k and a calcic horizon.

Pedon 5 is typical of a soil in which there is a calcic horizon of little genetic significance. The mollic epipedon and the natric horizon are significant to the classification of this soil. The presence of a horizon that has secondary carbonates is significant, but the absolute amount of lime in that horizon depends on both the amount of secondary carbonates and the amount of carbonates in the parent material.

---

1 If the soil above a lithic or paralithic contact, duripan or other restrictive layer is less than 50 cm (20 in.) thick the 15 cm (6 in.) requirement is-waived and the calcic horizon constitutes 30 percent or more of the solum.

PETROCALCIC HORIZON

Given a parent material that is rich in carbonates or given regular additions of carbonates in dust, the horizon tends in time to become plugged with carbonates and cemented into a hard, massive horizon that we call the pertrocalcic horizon. Such horizons seem to be mainly in soils older than the Holocene. In the early stages of development, the horizon has lime that is soft an disseminated or that has accumulated in hard concretions or both or represent alteration of bedrock. There may be cracks through the horizon, but the horizontal spacing is 10 cm or more. In consolidated materials, such as limestone, the stages in forming a plugged petrocalcic horizon involves alteration, in situ, of the parent rock and are accompanied by pendants on the lower surfaces of fragments. In such situations the secondary, pedogenically-enriched zone may contain less calciun carbonate than the parent rock due to enrichment with other iltuvial products of soil formation. The petrocalcic horizon is a mark of advanced soil evolution,

The petrocalcic horizon is a cemented or indurated calcic horizon that is cemented by calcium carbonate or in some places by calcium and some maqnesium carbonate. Accessory silica may be present. Dry fragments do not slake in water. There may be cracks through the horizon, but the horizontal spacing is 10cm or more. It usually cannot be penetrated by spade or auger when dry. It is massive or platy, very hard or extremely hard when dry, and very firm or extremely firm when moist. Noncapillary pores are filled, and the petrocalcic horizon is a barrier to roots. Hydraulic conductivity is moderately slow to very slow. The horizon is usually much more than 1 cm (0.4 in.) thick.

A laminar capping commonly is present but is not required. If one is present, carbonates normally constitute half or more of the weight of the laminar horizon, and the hardness by Mohs scale is 3 or more. Gravel, sand, and silt grains have been separated by the crystallization of carbonates in at least parts of the laminar subhorizon. Figure 3 shows a slice through the upper 13 cm of a petrocalcic horizon. Sand and gravel have been largely pushed aside by drystallization of lime at the surface of the laminar horizon. Radiocarbon dates of the organic and inorganic carbon indicate that this laminar horizon is late Wisconsinan to Holocene in age and that the cementation of the underlying gravel took place during the late Pleistocene.

If a laminar horizon rests on bedrock, it is considered a petrocalcic horizon if it is 1.0 cm or more thick and the dominant cementing agent is calcium carbonate.

Pedon 40 illustrates a soil that has a petrocalcic horizon. The petrocalcic horizon lies between depths of 28 cm and 64 cm. Plate 10D shows a soil with a petrocalcic horizon that has its upper boundary at a depth of about 70 cm and its lower boundary at a depth of about 150 cm.

COMMITTEE REPORT

COMMITTEE V - SOIL WATER

| Committee Membership: | | |
|---|---|---|
| | L. B. Ward (Chairman) | O. D. Philen |
| | Ken Bates | Blake Parker |
| | T. E. Calhoun | Larry Ratliff |
| | Steve Coleman * | J. T. Ritchie * |
| | Patrick Fink * | E.M. Rutledge * |
| | Westal Fuchs | J. N. Soileau |
| | Warren Henderson * | Lawson D. Spivey * |
| | Douglas Lowe * | B. N. Stuckey * |
| | c. H. McElroy | Howard Taylor |
| | B. J. Miller | B. A. Touchet |
| | D. L. Newton | |
| | Carolyn Olson | |
| | Ron Paetzold * | * Not present at conference. |

Charges: (a) Identify properties of soils that are related to the aquic moisture regimes.

(b) Evaluate applicability of the current concept of aquic moisture regimes.

(c) Evaluate problems in measuring soil water content and retention in clayey soils. (Bulk density changes, cracking, slow discharge rates, etc.)

Response to charge (a).

Properties common to soils with aquic moisture regimes include: reduction and gleying, resulting from biologic activity under anaerobic conditions (Smith, 1965); saturation by ground water or water from the capillary fringe; albic horizons and albic neoskeletons, higher organic matter contents and mottles and concretions due to the release and segregation of Fe and Mn.

Soil reduction takes place only when there is a sufficient supply of organic matter, absence of oxygen and presence of anaerobic microorganisms in an environment suitable for their growth (Bouma, 1983).

The duration of saturation affects many processes in hydromorphic soils including the intensity of soil reduction, soil reaction, mineral dissolution, translocation of soluble and suspended materials and accumulation of organic matter (Wilding and Rehage, 1984). When saturated chemical and microbial demand for oxygen greatly exceeds ogygen resupply so that the soil becomes anaerobic within a few hours or days (Turner and Patrick, 1968).

Albic horizons and albic neoskeletons on ped surfaces are one of the most prominent and distinguishing features of soils with aquic moisture regimes. (Bouma, 1983; Vepraskas and Wilding, 1983 a,b). These characteristics result from the eluviation of pigmenting and cementing compounds such as organic matter, clay and sesquioxides leaving uncoated skeletal grains.

Higher organic matter contents are common to soils with aquic moisture regimes because rates of decomposition are reduced due to cooler soil temperatures and anaerobic conditions. The rate of decomposition decrease as altitudes increase and at higher latitudes.

Alternating oxidation-reduction cycles result in the release of Fe and Mn from primary minerals and their segregation into mottles and concretions. The zone of maximum concentration of mottles, sesquans, nodules and petroferric material generally occurs near the upper boundary of fluctuating water tables (Hussian and Swindalc, 1974; Guthrie and Hajek, 1979) .

Other properties and processes associated with soils with aquic moisture regimes include; redox fluctuations, ferrolysis, mineral dissolution and synthesis, pedoturbation, pH changes, formation and destablixrmatioch soid

Problems with the current definition include: (a) the duration of saturation and anaerobic conditions is not specified; (b) low ($\leq 2$) chroma colors are based on Fe and Mn (not $O_2$) reduction; (c) $O_2$ measurement is difficult under field conditions and anaerobisis is difficult to verify; (d) aquic moisture regimes are difficult to verify in high shrink-swell soils; (e) soil moisture Control sections are not specifically defined.

The lack of redox and DO data. the high input requlred to obtain these data and problems interpretating the values encourages the use of other properties to determine the presence of an aquic moisture regime.

The use of morphological features associated with wetness (low chroma colors, mottles and concretions) was intended to be used to identify soils that have been artiflcally drained, but due to the lack of other data, most aqulc moisture regime are identified using these inferences.

Morphological inference alone are not always good indicators of the presence of an aquic moisture regime. Low chroma colors correspond more to the duration of FE reduction that to the duration of saturation in some soils (Vepraskas and Wilding, 1983 a, b. c). It is generally assumed that Fe-Un concretions and low chroma colors are contemporancous and not relict features (Schelling, 1960). The criteria are heavily biased toward low matrix and/or ped surface colors. Yet, many soils may have these colors and rarely undergo reduction. Others may be anaerobic and reduced, but not complctcly saturated. Soils with chroma of 3 or more on ped faces and higher chroma ped interiors may be saturated and reduced for short periods.

Some soils (fine and very fine, montmorillonitic and other high shrink-swell soils) are evidently saturated. reduced and free of DO for significant periods, yet water will not flow into an open bore hole as outlined in Soil Taxonomy. Using present methodology, these soils are difficult to evaluate.

In field situations, morphological inferences tend to be over emphasized and documentation is not obtained on the length of time the soil is saturated or if the water is stagnant in unlined bore holes. Dye techniques need to be refined and definod. Photochemlcal indicators, such as $\alpha$, $\alpha$' dipyrldyl and others have shown to be useful identifying zones of iron reduction, (Childs, 1981). Past. simple and inexpensive methods need to be developed for the field identification of aquic moisture regimes.

Response to charge (c).

Problems associated with the measurement of water contents and retention include: cost, time (slow discharge rates), accuracy, instrument calibration, conversion of data from gravimetric to a volumetric basis (bulk density charges and cracking) and spatial variability.

Sulk density changes and slow discharge rates are not unique to clayey soils. In fact, soils with coarse fragments often pose greater problems. Saline soils, sandy soils and forest soils each pose problems in the measurement of water content and retention. Bulk density changes and cracking as a function of water content may be more pronounced in clayey soils, but the technology is available for these measurements. Since problems in measuring water contents and retention are not unique to clayey soils alone, the response to the change is not restricted to clayey soils.

Soil water measurement problems can be divided into those associated with measuring water contents and those associated with measuring water retention. These can be further divided into field measurements and laboratory mcasurcmonts.

For laboratory situations, gravimetric soil water content measurement by oven drying is the standard method and presently is the most economical and practical method available. This method is the standard to which others are compared for accuracy.

For field situations, sampling for the oven drying method presents some practical problems, the most critical of which is time. This method is vet-y time consuming especially when travel and sampling time are included. Other field methods have been used with varying degrees of success. Each method must be evaluated in terms of the project objectives, the individual field situation (shrink-swell potential, salinity, coarse fragments. spatial variability, sampling depths, etc.). and cost in both tine and money. If a suitable method cannot be found to give the desired results at a reasonable cost. then it is better to abandon or delay the project than to waste time and money on a cheaper method that does not yield acceptable results.

Measurement of soil water retention is another story. Laboratory and field measured values are often quite different. There are a great many sources of error for both methods. Great pains generally are taken in the laboratory to insure complete saturation of the sample with water, whereas in the field, soils are rarely if ever completely saturated with water. Laboratory samples generally are unconfined which can lead to serious errors in clayey soils particularly those with high shrink-swell properties. In field methods, soil water content and potential are measured at different locations (close but different) which can result in rrors. Field instruments are subject to a variety of errors due to temperature effects, salinity effects, and calibration problems (including drift). Other sources of error for either or both methods include lack of equilibrium, soil hysteresis, instrument hysteresis, temperature fluctuations and gradients, sample height, entrapped air, spatlal variability, wetting technique and sampling technique. Both field and laboratory measurements of water retention are very time consuming.

In summary, cost, time and accuracy are main problems. We are constantly striving for methods that are rapid, inexpensive, and accurate. In practice, we are always making "trade. off s" among these three variables. The method chosen will depend on the accuracy required for the intended use and the amount of money and/or time we are willing to spend for the measurement.

Other concerns:

Some problems associated with soil water measurements stem from the application of the data. For example, when an index value such as 1500 kPa water content is used as the permanent wilting point (PWP) without considering other factors such as vegetation, hydraulic conductivity, root distribution, climate, etc. The PUP is a variable dependent on the interaction of many Factors.

The estimation of 33 and 1500 kPa water contents, estimation of Field capacity. permanent wilting point and available water capacity are problems associated with soil water contents and retention that are encountered by Field personnel on a daily basis.

Recommendations :

1. It is recommended that the soil water committee be continued.

2. The current definition of an aquic moisture regime does not specify the magnitude of reduction necessary, the allowable 02 content or the method of measurement. Nor is the duration or depth of saturation specified.

   It is recommended that Future committees be charged with making specific recommendations on the measurement of these parameters.

3. The difficulty of obtaining data on reduction, 02 contents, saturation and the inconsistency of morphological features shows the need for field tests to identify aquic moisture regimes.

   It is recommended that future committees be charged with identifying and testing new Field methods of identifying aquic moisture regimes.

4. Problems with aquic moisture retgimes are not restricted to the southern United States. An international committee on aquic moisture regimes (ICOMAQ) was recently Formed to study aquic regimes on an international basis.

   It is recommended that future committees stay abreast of proposals and development of this international body and proposals and recommendations of this committee and future committees be forwarded to this body For their consideration.

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Committee VI - Use of soil survey in Research and Management of Forestland

Chairperson: Allan E. Tiarks

Members:

| | | |
|---|---|---|
| Pete Avers | Glenn Harris | Sunkil Pancholy |
| Robert Baker | Joe McCoy | Rodney Peters |
| N. Comerford | Glen Mayhew | Terry Sarigumba |
| Don Eagleston | Calvin Heier | Glen Smalley |
| Bill Goddard | Frank Miller | Ken Watterston |
| Sharon Haines | Dan Neary | |

Charges:

(a) Identify methods to evaluate soil productivity in forestland

(b) Identify soil productivity data held by various agencies and recommend a feasible interface of this data base with a soil data base

(c) Current status of research in forestland

## Committee Report

As the intensity of forest management increases, foresters will make greater use of management tools such as graphical information systems and growth and yield models to aid in decision making. Using 211 the tools available, the forester can predict the best time to fertilize, thin or perform other management practices on a particular site to get a desired tree size and volune. All of these management tools require reliable and complete soils information about the site, including productivity data.

Charge 1. Identify methods to evaluate soil productivity in Forestland

1. The present system of reporting site index can be greatly improved by including more of the inform&ion that is already being collected. On dominant soils where multiple site index measurements have been made for a species, the number of measurements, range of site indices measured and the variability of the measurements should be reported. The range would also highlight mapping units that really contain two soil units in terms of forest productivity. Then if warranted and if mappable the division should be made.

2. Site index is partially dependent on soil properties, climate and past management, as well as species. These variables place restrictions on the geographical area where site index measurements will be valid. Site index curves need to be developed and used within each geographical region where a species is grown on a soil. The Forest Habitat Regions developed by the Southern Forest Environmental Research Council may be useful to develop the ranges that site index curves and measurements can be applied. When several intensities of management are used within a region, site index measurements need to be developed for each significant management intensity.

3. If no measurements or insufficent measurements of site index are available for a minor soil or tree species within a habitat region and the reported value is estimated then the value should be footnoted as being estimated.

4. Soil factors that limit productivity should be identified and reported as well as the gains that can be made by reducing these limitations where possible. Examples of these limitations include wetness, nutrient deficiencies, and restrictive horizons. The range of practices that can be used to reduce the effects of these limitations should be reported as well as the effect each has on productivity of the site.

5. The height growth pattern of a tree species is partially dependent on soil properties as well as climatic factors. Use of standard site index curves does not recognize this influence of soil on the shape of the height over age curve. Large errors can then occur, especially at ages greatly different than the base age. As a long-term goal, height over age curves need to be developed for soil series or a grouping of soils base on taxonomy or other methods of combining soils that produce the same height over age growth pattern.

6. The two standard methods of determining height over age curves are periodic measurements of permanent plots where tree identity is maintained and stem analysis. Both methods are expensive and time consuming. Many long-term plots have been established and maintained, although usually for other reasons. The distribution on different soils and different Forest Habitats is not complete. However, these soils could be checked with temporary plots. Stem analysis could be used to fill gaps where no long term plots exist in a region.

7. Details that will have to be worked out as some experience is gained in developing height over age curves for soil-species combinations include a) the age range that needs to be covered, b) the method to group soils that produce similar height over age grdh patterns, c) and the effect that management practices will have on the height over age curves.

8. The measurement and reporting of forest producivity on soil sites is a continuing problem as evidence by the many parallel recomendations of this report and the report of the last forestry committee. Major investments of resources will be required to make progress on the problem. The committee recommends that existing cooperative institutions such as the Southern Forest Environmental Research Council be asked to evaluate the problem and if they can assist in the work.

Charge 2. Identify soil productivity data held by various agencies and recomend a feasible interface of this data base with a soil data base.

The following organizations have data bases that could be used to develop height over age curves for soil grouping-species combinations.

1. Soil Conservation Service: The forest-soil data base may supply an adequate beginning for some soil-species combinations. Main limitations are the relatively low number of plots and a narrow age range.

2. Forest Service: The Forest Survey (South and Southeast1 have permanent plots spaced on three mile intervals that have been measured on ten year cycles. Plans are to go to five year cycles. Soils have not been identified.

Forest Service Research (South and Southeast1 maintain large numbers of research plots that are measured repetitively. In some instances individual tree identities have been maintained. Plot locations were usually chosen partly on soil uniformity although soils have not generally been identified. The location, age, species, and study objectives for all longterm plots in the two stations was summarized in 1981 by Sam Cingrich for the Southern Industrial Forestry Research Council.

3. TVA: Many forest site index plots were established by the TVA Forestry Division in the late 1950's and early 1960's. The plots were located in Georgia, Alabama, and Tennessee on Coastal Plain Soils. As the studies were installed with the cooperation of the SCS the results may already be incorporated into the forest-soil data base.

4. Universities: Several universities have growth and yield cooperatives including Stephen F. Austin, Mississippi State University, and University of Georgia. The amount of soils information, years of data collected and availability of the data vary with the cooperative. Fertilizer and genetic cooperatives also have repetitive data collected on plots that have uniform soils.

5. Except for the SCS, none of the organizations are collecting the information that can be directly used in developing soil-forest productivity relationships. However, in many cases the extra information could be collected with minimal effort. All the organizations should be encouraged to make interpetation for soil productivity part of their objectives when possible.

Charge 3. Current status of research in forest land

1. Enough research data has been accumulated in several areas that some of it should be considered for inclusion in soil survey reports in woodland interpretations. As this is done the users of the interpetations should be considered. The interpetations should be broad enough to cover the range of management intensities that are likely to be used on a mapping unit.

2. Damage to the soil from harvesting by increasing erosion, compaction, or nurient removal can *reduce* the productivity of a site substantially. While detailed recommentations for actual operations

are not possible in the soil survey report, enough information is available to identify the restrictions **of** a soil in terms of harvesting, the type of damage that can be done and should be avoided, and ways of correcting damage that has oocured.

3. The type of preplant preparation needed on a site is usually more dependent on non-soil factors such as the harvesting method and factors that may be indirectly related to the soil such as amount of competition present than on soil factors. The soil survey could be used to point out restrictions on some practices-such as erosion hazard, compaction, or nutrient relocation from the use of shearing. Some data on the effect of site preparation on soil productivity is available-both positive and negative. The effectiveness of soil-active herbicides depends upon soil properties such as organic matter and clay content of the surface.

4. For the insect and disease problems that are site dependent, some information could be included in the soil survey report. The annosus root rot is a good example of a disease that is related to certain soil conditions and where the research is complete enough that interpetations can be made. Others pests that may be site related are southern pine bark beetle tip moth and littleleaf disease.

5. Fertilizer requirements vary with stand conditions so that generalized recommendations will not be possible. However the soil scientist needs to be aware of the latest research information on forest fertilization because the mapping units may need to be adjusted to incorporate soil properties that affect fertilizer requirements. As an example, the chances that a site will respond to a preplant application of phosphorus can be estimated from properties such as the drainage class.

## RECOMMENDATIONS

It is recommended that the committee be continued. The previous committee identified ways that soil scientists could be better trained to make soil surveys more usable in forestry. The next charge should find ways of training foresters on the capabilities of soil survey in forest land management. Perhaps this process would also enhance the soil scientists'understanding of the ways that foresters use the soil survey. Other possible charges are to follow up on the progress of the soil productivity work or establish a erosion tolerance standard for forest and range land.

# NATIONAL COOPERATIVE SOIL SURVEY

## Southern Regional Conference Proceedings

**Orlando, Florida**
**May 16-21, 1982**


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# PROCEEDINGS
# OF SOUTHERN REGIONAL TECHNICAL
# WORK-PLANNING CONFERENCE
# OF THE
# NATIONAL COOPERATIVE SOIL SURVEY

Orlando, Florida
May 16-21, 1982

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

UNIVERSITY OF FLORIDA
INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES
GAINESVILLE, FLORIDA 32611

SOIL SCIENCE DEPARTMENT
G159 MCCARTY HALL
TELEPHONE: 904-392-1951

Subject: 1982 Southern Regional Technical Work-Planning Conference of the National Cooperative Soil Survey

To: Recipients of Proceedings

The general session convened at 8:00 a.m., Tuesday, May 18, 1982, at the Holiday Inn, International Drive, Orlando, Florida. Individual meetings of the Southern Regional Soil Survey Work Group and Soil Conservation Service Work Group were held on Monday, May 17, 1982, to discuss technical details of research, educational, laboratory, and field support programs associated with the National Cooperative Soil Survey. Representatives from Southern 1890 schools were invited to participate in all conference activities.

Appreciation and special thanks are extended by the Program Committee to Mr. C. R. Russ, Dean F. A. Wood, Mr. J. W. Mitchell, Dean J. T. Woeste, Mr. B. M. Johnson, Dr. R. J. McCracken, Mr. Fred Harden, Mr. Bob Lee! and Dr. Richard Arnold. These individuals contributed immensely to the success of our conference.

Committee chairmen and members are commended for the time and effort contributed to committee activities prior to the conference? conducting individual discussion groups, presenting preliminary committee reports, and developing the final committee reports which are included in these proceedings.

Texas will be the host state for 1984. Mr. Charlie Thompson, State Soil Scientist, Soil Conservation Service, was selected to serve as chairman and Dr. Larry Wilding will serve as vice-chairman.

The conference adjourned at 11:45 a.m., Friday, May 21, 1982.

Victor W. Carlisle
Chairman

Robert W. Johnson
Vice-Chairman

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# INTRODUCTION

The purpose of the Southern Regional Technical Work-Planning Conference is to provide a forum for Southern States representatives of the National Cooperative Soil Survey and invited participants for discussing technical and scientific developments pertaining to soil surveys. Through conference discussions and committee actions current issues are addressed, new ideas are exchanged and disseminated, new procedures are proposed, new techniques are tested, and conventional methods and materials are evaluated. Sharing individual experiences related to soil survey increases the participants proficiency in these research and teaching programs. Conference recommendations and proposals are forwarded to the National Technical Work-Planning Conference. Thus, the results form a basis for new or revised National Soil Survey policy or procedures, or both.

# AGENDA

## 1982 SOUTHERN REGIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE NATIONAL COOPERATIVE SOIL SURVEY

HOLIDAY INN
6515 International Drive
Orlando, Florida
May 16-21, 1982

Sunday, Flay 16

4:00 - 7:oo p.m. Registration (Foyer)

Monday, flay 17

8:00 - 8:30 a.m. Registration (Foyer)

8:30 a.m. - 5:00 p.m. Experiment Stations and Soil Conservation Service Workshops (see separate agenda)

Tuesday, May 18 -- GRAND HALL A

Presiding: V. W. Carlisle and R. W. Johnson

8:00 - 8:30 a.m. Announcements and Introductions

8:30 - 8:45 Welcome
C. R. Russ
Chairman, Lake SWCD and Past President, FACD
Clermont, Florida

8:45 - 9:15 Agricultural Research and the Florida System
F. A. Wood
Dean for Research, IFAS, Univ. of Florida
Florida Agricultural Experiment Station
Gainesville, Florida

9:15 - 9:45 Natural Resource Assessment Activities in Florida
J. W. Mitchell
State Conservationist
USDA Soil Conservation Service
Gainesville, Florida

9:45 - 10:10 Cooperative Extension Activities in Florida
J. T. Woeste
Dean fcr Extension, IFAS, Univ. of Florida
Florida Cooperative Extension Service
Gainesville, Florida

| | |
|---|---|
| 10:10 - 10:40 | Break (Foyer) |
| 10:40 - 11:00 | Role of the National Technical Center<br>B. M. Johnson<br>Director South NTC<br>Fort Worth, Texas |
| 11:00 - 12:00 | Soil Survey and Resource Planning<br>R. J. McCracken<br>Deputy Chief<br>USDA Soil Conservation Service<br>Washington, D. C. |
| 12:00 - 1:oo p.m. | Lunch |

| | Discussion Group I (Costa Brava) | Discussion Group II (Majorca) | Discussion Group III (Valencia) | Discussion Group IV (El Toro) |
|---|---|---|---|---|
| 1:00 - 2:00 | | | | |
| 2:00 - 3:D0 | | | | |
| 3:00 - 3:15 | | | | |
| 3:15 - 4:15 | | | | |
| 4:15 - 5:15 | | | | |

Thursday, May 20 -- GRAND HALL A

Presiding: Tommy Calhoun

| | |
|---|---|
| 8:00 - 8:30 a.m. | National Soil Survey Laboratory Report<br>Warren Lynn<br>USDA Soil Conservation Service<br>Lincoln, Nebraska |
| 8:30 - 9:00 | International Soils Program Report<br>John Kimble<br>USDA Soil Conservation Service<br>Lincoln, Nebraska |
| 9:00 10:00 | Break (Foyer) |
| lo:oo - 10:30 | Report of Committee 1 - Digitizing Soil Maps<br>Chairman: C. A. Steers |
| 10:30 - ll:oo | Report of Committee 2 - Soil Variability and Quality Soil Surveys<br>Chairman: B. F. Hajek |
| 11:oo - 11:30 | Report of Committee 3 - Training Soil Scientists<br>Chairman: E. R. Blakley |
| 11:30 - 12:oo | Report of Committee 4 - Soil Surveys and Land Assessments<br>Chairman: G. E. Kelley |

Thursday, May 20 -- GRAND HALL A

Presiding: M. E. Collins

| | |
|---|---|
| 1:30 - 2:oo p.m. | Report of Committee 5 - Evaluation of Hydraulic Conductivity Data<br>Chairman: C. T. Hallmark |
| 2:00 - 2:30 | Report of Conmittee 6 - Classification and Interpretation of Soils with Bedrock<br>Chairman: T. E. Calhoun |
| 2:30 - 3:00 | Report of Committee 7 - Calculation and Evaluation of K Factors<br>Chairman: D. A. Lietzke |
| 3:oo - 3:30 | Break (Foyer) |
| 3:30 - 4:oo | Report of Committee 8 - Soil Survey and Woodland Interpretations<br>Chairman: P. Avers |

4:00 - 5:oo — Application and Interpretation of GPR
James Doolittle
USDA Soil Conservation Service
Gainesville, Florida

Thursday, May 20 -- GRAND HALL C and GRAND HALL B

6:00 - 7:00 p.m. — Mixer and Social Hour

7:00 - 9:oo — Banquet
Address: Histosols and the Sugar Industry in Florida
Bob Lee
U. S. Sugar Corporation
Clewiston, Florida

Friday, May 21 -- GRAND HALL A

Presiding: R. W. Johnson and V. W. Carlisle

8:00 - 8:30 a.m. — Comments by Experiment Station Director's Representative
D. M. Gossett
Dean of Agriculture
University of Tennessee
Knoxville, Tennessee

8:30 - 9:30 — Comments by Director of Soils
Richard Arnold
USDA Soil Conservation Service
washington, D. C.

9:30 - 9:45 — Break (on your own)

9:45 - 10:45 — Comments by Regional Representatives and Agencies Relating to NCSS

10:45 - 11:30 — Comments by Principal Soil Correlator
Joe Nichols
USDA Soil Conservation Service
Fort Worth, Texas

11:30 - 12:00 — Conference Business Meeting

ADJOURN

AGENDA

SOUTHERN REGIONAL SOIL SURVEY WORKING GROUP*

Monday, May 17, 1982

Monday, May 17, 1982 - L. P. Wilding, Presiding, Texas A&M University

| | |
|---|---|
| 8:30 - 8:45 | Introduction Purpose of meeting, structure, membership, etc.<br>L. P. Wilding |
| 8:45 - 9:15 | Methodology for Teaching Soil Taxonomy<br>B. L. Allen (Chairman); H. F. Perkins and E. M. Rutledge |
| 9:15 - 9:45 | Employment Trends and Curricula for Future Pedology Graduates<br>S. W. Buol (Chairman); B. F. Hajek and D. C. Pettry |
| 9:45 - 10:00 | Status Soil Taxonomy Revisions within South Region<br>C. T. Hallmark (Chairman); W. F. Hudnall |
| 10:00 - 10:30 | BREAK |
| 10:30 - 11:00 | Direction of Future Research Possible Regional Project<br>D. Lietzke (Chairman); C. T. Hallmark and B. G. Hajek |
| 11:00 - 11:30 | Interfacing Cooperative Extension Contributions to Soil Survey<br>B. L. Harris (Chairman); J. Kleiss and R. B. Brown |
| 11:30 - 12:00 | NCSS Direction When State is Mapped Once Over<br>B. J. Miller (Chairman); B. R. Smith and Mary Collins |
| 12:00 - 1:00 | LUNCH |
| 1:00 - 3:00 | State reports on NCSS program status, state contributions, supporting research, laboratory characterization, special projects. (Each state is allowed 20 minutes. Bring a few slides to illustrate presentation if desirable. Prepare not more than a one-page summary for distribution). |
| 3:00 - 3:30 | BREAK |
| 3:30 - 5:30 | State reports continued |

*This meeting is open to all conference participants. Please attend any session that may be of interest to you.

AGENDA

Soil Conservation Service Working Group*
Monday, May 17, 1982

| | | |
|---|---|---|
| 8:15 - 8:30 | Opening | Nichols |
| | Soil Survey Operations | |
| 8:30 - 9:00 | Budget outlook FY-82/FY-83 and the soil survey program | Arnold |
| 9:00 - 9:30 | Non-federal funds for soil survey | Byrd, Johnson, Touchet |
| 9:30 - 9:45 | Break | |
| 9:45 - 10:00 | Staffing of soil scientists as soil surveys are completed in states | Arnold |
| | Soil Classification | |
| 10:00 - 10:15 | Chapter 4 of Soil Survey Manual | Nichols |
| | Interpretations | |
| 10:15 - 10:30 | Ratings for septic tanks on sandy soils | Williams |
| 10:30 - 11:00 | Updating SOILS-S's with actual laboratory and field test data | Blakley |
| 11:00 - 11:15 | Hydric soils coordination | Williams |
| 11:15 - 11:30 | New woodland interpretations | Williams |
| 11:30 - 11:45 | Interpretations for flooded soils | Williams |
| 11:45 - 12:00 | Prime farmland coordination | Blakley |
| 12:00 - 1:00 | Lunch | |
| 1:00 - 1:15 | Soil potentials update | Williams |
| | Correlation | |
| 1:15 - 1:30 | Application of Chapter 5, Soil Survey Manual | Nichols |
| 1:30 - 3:00 | State Soil Scientists' Time - Open for discussion and comments | Chairman Johnson |

| | | |
|---|---|---|
| 3:00 - 3:30 | Break | |
| 3:30 - 4:00 | Training of soil scientists | Blakley |
| 4:00 - 4:15 | National Soils Handbook and AMS | Arnold |
| 4:15 - 4:30 | Long range plans for soil surveys on USDA Forest Service lands | Avers |
| 4:30 - 5:00 | Open for questions | Chairman Koos |

*This meeting is open to all conference participants. Please attend the session that is of interest to you.

SOUTHERN REGIONAL TECHNICAL WORK-PLANNING CONFERENCE
OF THE NATIONAL COOPERATIVE SOIL SURVEY

Holiday Inn, International Drive
Orlando, Florida
May 17-21, 1982

Minutes of the Business Meeting, May 21, 1982
V. W. Carlisle, Presiding

At individual meetings of the Southern Regional Soil Survey Working Group and Soil Conservation Service Working Group held on Monday, hay 17, 1982, four members were selected to serve on the Committee for Amendments to Soil Taxonomy. B. L. Allen and D. A. Lietzke were added to the Experiment Station representatives. B. C. Hallbick and D. L. Newton were added as representatives from participating Federal Agencies. Present membership of this committee and service terms are as-follows:

| State Members | Federal Members | Terms |
|---|---|---|
| B. J. Miller | W. M. Koos | March 1980-March 1983 |
| C. T. Hallmark | P. E. Avers | March 1981-March 1984 |
| B. L. Allen | D. C. Hallbick | March 1982-March 1985 |
| D. A. Lietzke | D. L. Newton | March 1983-March 1986 |

Dr. Stan Buol introduced for discussion the possibility of reprinting Southern Cooperative Series Bulletin No. 174, Soils of the Southern States and Puerto Rico. He estimated the cost of reprinting 3 000 copies at approximately $316.00 per state on an equal share basis: A poll of representatives from various states indicated that most favored reprinting; however, the number of reprints needed was not clear because of uncertain present inventories. Dean D. M. Gossett, Directors' Representative, outlined appropriate procedures that should be followed to have this bulletin reprinted. Dr. Buol volunteered to determine, through correspondence, the number of copies available in each state and to continue interfacing with Dean Gossett until the number of reprints desired by each state is determined.

Some time was devoted to a discussion of the 1982 conference format. The consensus was that the discussion group approach is excellent and should be continued; however, a minimum amount of time is needed for presentation of committee reports to the general assembly and a formal meeting of each committee in the early stages of the conference would be highly desirable. These recommendations will be passed on to the Conference Steering Committee.

Dr. George Buntley expressed concern regarding the omission of cultural features on maps in published soil surveys. After considerable discussion, mostly favoring the placement of cultural features, Dr. Buntley cheerfully consented to assume responsibility for constructing the following resolution:

"Since in recent years some of the cultural features have been left off the published soil survey maps, and since the omission of these cultural features has made it increasingly difficult for users of soil surveys to locate themselves on the maps, therefore be it resolved, that the Southern Regional Technical Work-Planning Conference of the National Cooperative Soil Survey, in the interest of improving usability of soil surveys strongly recommends that all cultural features, including all roads and houses other than those within cities and towns, be shown on the published soil maps wherever needed. The need for including these cultural features on the published maps for the express purpose of improving the usability of the maps should be determined within each state on a county-by-county basis by the various cooperators of the National Cooperative Soil Survey."

Dr. Billy Harris, on behalf of the Southern Regional Soil Survey Working Group, expressed appreciation to the Soil Conservation Service for their part in the leadership of the National Cooperative Soil Survey and their continued strong support of soil and land judging activities at county, district, state, regional, and national levels. A resolution conveying sincere appreciation and gratitude will be incorporated into the minutes for the Southern Regional Soil Survey Working Group with a recommendation that appropriate administrative action be taken to award these contributions.

Les Brockman extended an invitation for the 1984 conference to meet in Texas. This invitation was accepted by the conference. The exact time and location will be announced; however, representatives from Texas will investigate the feasibility of a joint Southern Region and Western Region 1984 Conference.

Appreciations were expressed by the Chairman and Vice-Chairman to conference participants for their willingness to accept responsibility and excellent cooperative spirit.

There being no additional business, the conference adjourned at 11:45 a.m., Friday, May 21, 1982.

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## COMMITTEE I - DIGITIZING SOIL MAPS

Chairman: Carter Steers

Vice-Chairman: R. H. Griffin

Members: Patricia Fink, Talbert R. Gerald, Arnold Molina, Darwin L. Newton, Blake Parker, D. E. Pettry, Ben N. Stuckey, Jr., Charles M. Thompson, L. B. Ward, Jack Chugg

Charges:

1. Determine feasibility for digitizing.

   (a) Published soil surveys.

   (b) Interpretative maps.

2. Identify sources and determine costs.

3. Evaluate advantages and disadvantages for:

   (a) Developing interpretative maps
   Use other computer methods
   (MIADS, etc.)

   (b) Compiling and finishing soil maps for publication.

This committee's recommendation is based primarily on material returned with a questionnaire sent to state soil scientists of the South and other National Technical Centers which, in turn, distributed the questionnaires. Responding were 20 state soil scientists outside the South, 10 within the South, and 10 other office or staff members.

CHARGE 1 - Determine feasibility for digitizing.

(a) Published soil surveys.

(b) Interpretative maps.

We have recommended 3 alternatives for the feasibility of digitizing published soil surveys.

Alternative 1 of Charge 1(a) - A complete National or state spatial soil data by line segments (polygon base) is outside the realm of present SCS capabilities.

Justification:

(a) Cost is projected at approximately $205 million for U.S.A. land areas and is projected at approximately $3 million for Alabama for polygon soil data base.

(b) Time is projected to require 21,825 man-years to digitize a completed line-segment spatial soil data base of U.S.A. and 313 man-years for a state the size of Alabama. This would require 17 years of full-time work for all NCSS soil scientists to enter soil data base or would involve 14 years of all Alabama's present soil scientists to digitize polygon soil data'base for Alabama.

(c) Neither the SCS nor our cooperators within the NCSS program have either hardware or software to provide a successful delivery of such large data bases for overlaying data and soil interpretative output.

Alternative 2 of Charge 1(a) - The feasibility of line segment digitizing for published soil surveys is dependent on the stage of soil map preparation and on intensity of expected use of spatial soil data. We recommend a survey by survey evaluation of the followinq survey areas to determine justification for polygon data file preparation.

(a) New surveys where map compilation and map finishing is still in planning stages.

(b) Old soil surveys where use is very high and additional funds are available for soil digitizing.

Justification:

(a) The benefits are more widely spread and outside funds can be fully utilized.

(b) Soil surveys that have not been published allow for certain time and money saving features in preplanning of the map publication process.

Alternative 3, Charge l(a) - A large spatial data base such as a national soil data base or a state soil data base should consist of grid cell format and guides issued for its standards. This format should also include a system for variable size grid cells to accommodate the intensity of soil survey and interpretative needs.

Justification:

(a) Cost is projected at approximately $9,250,000 for U.S.A. land areas and is projected at about $63,756 to complete the state of Alabama soil cell data base.

(b) Time is projected to require 3,000 man-years to code U.S.A. area by grid at a cell size of 2.5 to 25 acres. Alabama could be completed with approximately 21 man-years' time. These figures would require all NCSS soil scientists 1 and 3/4 years to complete and Alabama soil scientists 0.95 man-year time with their respective areas.

(c) The high cost involved in storage and data output for polygon data bases compared to grid cell data bases. The ratios of cell to polygon are 1:486+ and 1:16, respectively.

(d) More of our users of spatial soil data are presently using grid cell systems, (tax accessment, coal producers, crop forecasting, census, etc.).

Recommendation for Charge l(b) - Interpretative soil maps should not be digitized as a part of the NCSS program. The NCSS should provide soil data files and the associated guide to soil interpretation which, in turn, can interface and result in computer generated interpretative maps.

Justification:

(a) Digitizing one purpose map base from soil survey such as an important farmland map is an unwise investment of time and money. Digitize soil information and produce interpretative maps. The data base is then available for future use.

(b) The reliability of interpretative maps to many users will be much higher when it is directly produced from an edited soil data base.

CHARGE 2 - Identify sources and determine cost. We have primarily devoted our time to line segment digitizing due to the fact that cell digitizing is so commonly produced in the South NTC area and a contract has been issued for this type of work each of the last 7 years.

The contractors listed below have all completed soil data bases of soil survey areas. We also want to emphasize these estimates of cost are exactly that--estimates. They were gathered primarily by phone and misunderstandings are very possible. However, this is a list of qualified contractors and the estimates of cost are provided only as guides in planning.

**Recommendation for** Charge 2 - We recommend the following list of contractors to those interested in contracting line segment digitizing. The estimated cost is for completing a soil data base capable of producing map negative for atlas sheet publication and of overlaying other data bases to provide combined data files.

| | |
|---|---|
| Argonne National Laboratory<br>Applied Mathematic Div.<br>Central Computer Facility<br>U.S. Dept. of Energy<br>Argonne, Ill. 60439<br>Contact: Bob Lima<br>Ph. 312/972-7130 | <u>Scan Digitizing</u><br>cost: Average for counties range from $12,000 to $80,000. (Area of counties range from 320,000 to 480,000 acres)<br>($6,154 per quad) |
| Compu Route Inc.<br>2701 National Place<br>P. 0. Box 2479<br>Garland, TX 75401<br>Contact: Don Wilson<br>Ph. 214/278-0543 | <u>Manual Digitizing</u><br>Estimate cost of $68,640 on a county in NC or 22 quads.<br>($3,120 per quad) |
| Data Map Computer Data and Map Service<br>3426 Sansom St.<br>Philadelphia, PA 19104<br>Contact: William C. Murphy (Bill)<br>Ph. 215/386-5960 | <u>Manual Digitizing</u><br>Estimate $3,500 to $5,000 per quad. |

TVA Office of Natural Resources
Norris, TN 37878
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Environmental Systems Research Institute
380 New York Street
Redland, CA 92373
Contact: Jack Dangermond
Ph. 714/793-2853

Manual Digitizing
Estimate $1.50 per polygon. (About $2,400 per quad)

IOM-TOWILL
1765 Scott Boulevard
Room 210
Santa Clara, CA 95053
Contact: Robert D. Pettit
Ph. 408/985-1810

Semi Automatic Digitizing
Estimated cost is $17.50 per meter of lines and $0.35 per symbol. ($5,100 per quad)

Justification: Cost variation is understandable due to the fact of great difference in intensity of soil boundaries, scale, area differences in quads, and software program used.

CHARGE 3 - Evaluate advantages and disadvantages for:

(a) Developing interpretative maps. Use other computer methods (MIADS, etc.).

(b) Compiling and finishing soil maps for publication.

The questionnaire points out definite advantages and disadvantages of both line segments and grid cell digitized data entry formats.

Recommendation for Charge 3(a)(1) - The following advantages and disadvantages are considered the most important for cell coded data base and the listing is in order of preference shown.

Advantages:

1. A feasible cost to enter, store, and retrieve data.

2. The overlay capability for additional data files to make better use of a soil data base.

3. The simple and easy methods used in data entry.

4. The wide diversity of data use.

5. The small investment and operating cost for hardware, software, and storage of soil data base.

Disadvantages:

1. Poor appearance of map or graphic displays in data output which consists of angular boundaries between map units.

2. Lack of automated data entry for operational programs.

3. Lack of site specific soil accuracy of map or graphic output.

4. Reliability of data questioned by some users.

Recommendation for Charge 3(a)(2) - The following advantages and disadvantages are considered the most important for polygon data base and the listing is in order of preference shown.

Advantages:

1. Data output is by line which is in the original map format.

2. The map obtained from data base is available at the same accuracy of the original soil manuscript map.

3. Broad user acceptance.

4. Procedures can be designed to provide soil data base and also used for map finishing and computation process.

5. Soil data base can be converted from polygon base to grid cell data base.

Disadvantages:

1. Extremely high cost for data entry.

2. Long time requirement for data entry.

3. Large size requirements for computer or data processor to handle soil data base files.

4. Problems with data overlay capability in using other resource data files.

Recommendations for Charge 3(b) - Technology, equipment, and trained personnel are available for soil map digitizing by line segment for soil map compilation, map finishing, and polygon data base development as a one time process. This process should be considered for all soil survey areas where final map compilation and map finishing steps have yet to start. Line segment digitizing can be feasible for one or both purposes--compilation and map finishing, or soil data base development for soil interpretation.

Advantages for computer map compilation and finishing of atlas sheets for publication are:

1. Line segment digitizing completes two jobs by one procedure. This method provides quality negative for map publication and a reliable data base for soil interpretation.

2. Work can be contracted saving SCS personnel time.

3. Resulting soil data base can be utilized either as polygons or cells.

4. Line digitizing vs. line-segment digitizing has been used by at least one state as a cost and time effective method. This type of digitizing records only line work and does not identify line segments or line intersections or individual polygon location or identification.

   Therefore, data records cannot be used for soil interpretative data bases. However, high quality map finishing has been done at reasonable cost by this procedure.

Disadvantages for computer map compilation and finishing of atlas sheets for publications are:

1. Line segment digitizing is extremely costly. Most soil survey areas can be completed with normal procedure and grid-cell coded for data base at much less cost than the line segment data entry and edit cost.

2. Time requirement is great for data entry.

3. The Soil Conservation Service does not have equipment or personnel in states to do this work.

4. Quality control and edit of atlas sheet would require new procedures in soil correlation.

There was a suggestion from one of the discussion groups that possibly a committee should look into the misuse of digitizing soil information as well as other soil data bases. This is out of the range for our charges but is of concern. We recommended discontinuing this committee.

## COMMITTEE II - SOIL VARIABILITY AND QUALITY SOIL SURVEYS

1982 Southern Regional Technical Work-Planning Conference of the National Cooperative Soil Survey.

Chairman: Ben F. Hajek

Vice-Chairman: W. M. Koos

Members: Fred Beinroth

J. H. Brown

J. A. Doolittle

W. W. Fuchs

Fenton Gray

C. W. Hail

R. B. Hinton

A. L. Newman

Larry Ratliff

B. A. Touchet

L. P. Wilding

Committee Report:

Charge 1 Continue charge of 1980 committee to explore and recommend methods for conveying variability in soil mapping units and interpretations to users (confidence limits, percent inclusions, etc.).

Recommendation - The National Technical Service Center soils staff should issue guidelines to state staffs giving alternative methods for field data collections and data analysis. Sampling and statistical methods exist and should be incorporated into the soil survey memorandum of understanding and work plans. Statistically based data will be used for quality control evaluations in progress reviews and to express confidence in map unit composition.

Charge 2 Prepare examples of variability in soil mapping units for use in published soil surveys.

Recommendation - Published soil surveys should include a table of statistical data and the method used to obtain composition data such as, transects, grids, random points, remotely senced points, etc.

Table 1. Example of a map unit statistical table

| Mapping Unit Name | Symbol | Components | Percent | Range | Confidence* level |
|---|---|---|---|---|---|
| A-B-C | 12 | A | 37 | 7 | 90 |
| | | B | 26 | 4 | 75 |
| | | C | 20 | 8 | 80 |
| B | 6 | B | 87 | 5 | 95 |
| | | C | 42 | | |
| C-B | 16 | D | 20 | 20 | <70 |
| | | | | 10 | <70 |

* could use confidence level range eg. >90; 90-80; <80

All map units would not have to be evaluated since soil surveys do not publish nor do they analyze every unit. The following are examples of how compositional data was included into map unit descriptions in a soil survey.

64F--Smithdale-Providence association, hilly. This unit consists of well drained Smithdale soils and moderate well drained Providence soils on rolling ridgetops, side slopes, and in drainageways. These soils are in a regular and repeating pattern. Smithdale soils are on the middle and lower side slopes, and the Providence soils are on the ridgetops, upper side slopes and narrow ridges. Slopes range from 12 to 35 percent. Areas range from 160 to more than 800 acres.

There is a 90 percent probability that Smithdale and similar soils range from 32 to 44 percent of the mapped area.

Typically, the surface layer is dark grayish brown fine sandy loam about 2 inches thick. The subsurface layer to a depth of about 15 inches is pale brown very fine sandy loam. The subsoil to a depth of about 41 inches, is yellowish red clay loam, The lower part of the subsoil to a depth of about 75 inches, is yellowish red sandy loam, with pockets of pale brown uncoated sand. The subsoil extends to a depth of about 80 inches or more.

Smithdale soils are very strongly acid or strongly acid throughout. Permeability is moderate. Available water capacity is high. Runoff is rapid, and erosion hazard is severe. The water table is deeper than 6 feet. The rooting zone is deep and easily penetrated by plant roots.

There is a 90 percent probability that Providence and similar soils range from 25 to 41 percent of the mapped area.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 60 inches or more.

The idence and s range from 25 t strongly acid or s demediumdthroughout.

To a depth of about 22 inches is yellowish red silty clay loam. The next layer to a depth of about 31 inches is a strong brown silt loam. The next layer to a depth of 63 inches is a firm compact, and brittle fragipan. It is yellowish brown mottled in shade of brown and gray.

These soils are poorly suited to most urban uses because of the rolling and hilly topography that has mostly steep side slopes, which causes severe seepage in the Smithdale soils. Providence soils on ridgetops that have slopes less than 8 percent slopes are suited to dwelling sites but have severe limitations for septic tank absorption fields because of moderately slow permeability in the fragipan. All of the steep side slopes have severe limitations for septic tank absorption fields because of the slope gradient.

The Smithdale soils are in capability subclass VIIe and woodland suitability group 301; Providence soils are in capability subclass IIIe and woodland suitability group 307.

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BOE Bonwier-Stringtown association, hilly. These deep, loamy soils are on uplands on ridgetops and side slopes. Slopes range from 5 to 20 percent. Soil areas are mostly irregular in shape, but some are long and narrow. Soil areas range from 40 to 325 acres.

This association is 60 to 75 percent Bonwier soils, 20 to 30 percent Stringtown soils, and 5 to 10 percent other soils. These percentages were determined by taking samples from random transects made across mapped areas.

Bonwier soils are on the crests of ridges. Stringtown soils are on convex surfaces and side slopes of ridges. Other soils in this association are Doucette and Shankler soils on concave, middle and lower slopes and Urland soils on ridgetops and upper side slopes.

Typically, the surface layer of Bonwier soils is strongly acid fine sandy loam about 9 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The subsoil to a depth of 33 inches is very strongly acid, red clay that is mottled with light gray and dark yellowish brown in the lower part. The underlying material to a depth of about 60 inches is very strongly acid, gray, red, and yellow stratified clay, clay shale, and sandstone.

Typically, the surface layer of Stringtown soils is very strongly acid fine sandy loam about 10 inches thick. It is dark grayish brown in the upper part and yellowish brown in the lower part. The subsoil to a depth of 45 inches is very strongly acid, strong brown sandy clay loam that has mottles of gray, red, and yellow. It is about 2 percent plinthite in the lower part. To a depth of 60 inches the soil is extremely acid, mottled red, yellow, and gray, stratified shale and soft sandstone.

These soils are well drained. Permeability is moderate, and runoff is medium to rapid. Eonwier soils have low available water capacity and Springtown soils have high available water capacity.

Areas of these soils are used mainly as woodland. The potential productivity is low for pine trees on Bonwier soils and medium for pine and hardwood trees on Springtown soils. Dominant trees are loblolly pine, shortleaf pine, and mixed hardwoods. The main limitation is the clayey subsoil in the Bonwier soils. These soils have an erosion hazard if the vegetation is removed.

The potential for the production of understory plants that can be grazed by livestock and game animals is very high for Bonwier soils and medium for Springtown soils. Plant competition reduces the production of forage plants on Sprintown soils. Major understory plants in a well managed woodland are pinehill bluestem, sedges, slender bluestem, low panicum, Carolina jessamine, brownseed paspalum, pineywoods dropseed, waxmyrtle, blackberry, and American beautyberry.

Some areas of these soils are used as pasture. The potential for pasture and hayland plants is medium. The main limitation is the clayey subsoil in the Bonwier soils. Proper fertilization, liming, grazing management are necessary for best production of improved bermudagrass and bahiagrass, crimson clover, and arrowleaf clover.

The potential is low for urban uses of these soils. The main limitations are slope and the shrinking and swelling of the soil with changes in moisture content. Low strength is a limitation for local roads and streets.

These soils are in capability subclass VIe. The Bonwier soils are in woodland ordination group 4c2, and the Springtown soils are in woodland ordination group 307.

Charge 3 — Investigate feasibility of standardizing procedure for determining variability within a map unit.

Recommendation - Procedures cannot be completely standardized. If possible transects should be used, however, grid-point methods may be needed (for example in nearby level featureless, wooded areas). Map unit delineations should be the statistical individual when an entire survey is considered. Of course, if need exists, within pedon, between pedon, and polypedon variability or uniformity can be statistically sampled and expressed. It is important to remember that we use areas of land not points. Thus sampling points must be designed to represent such land area use concepts as "minimum use size."

Charge 4 — Suggest variability limits to evaluate soil survey "quality".

Recommendation - Quality should be expressed in terms of: average percent, plus-minus (±) range around the average percent, and probability that the average percent is within the (±) range. A fixed probability (80-90%) seems the best way tc begin. The (±) range would then reflect "quality."

General Recommendation - The work of this committee should be continued and charged to propose methods to statistically evaluate existing soil surveys as part of updating.

## COMMITTEE 3 - TRAINING SOIL SCIENTISTS

### Charges

1. Circulate the suggested course listing for students in soil science to appropriate schools and agencies.

2. Compile an evaluation of the course listings by these schools and agencies.

3. Develop a training guide for field soil scientists.

### Introduction

This committee assignment was a continuation of the 1980 Southern SSWPC. During that session the committee was not able to address all the charges assigned. Consequently, it focused its concern mainly on the charge of developing a suggested Course Listing for students in soil science. That list is attached to this report. The concern this session was how to make distribution of the course list and how to evaluate the responses.

This report also concerns training for field soil scientists and the development of a more uptodate field training guide. Considerable time was devoted to this. Training is a subject that has commanded considerable attention the past few years. Various aspects of training and educational requirements have been the subject of committee assignments at several recent Soil Survey Work Planning Conferences. Some of the committee reports that provide pertinent comments and information are in the proceedings of the 1978 and 1982 Western Regional Conference, the 1980 Northeast Regional Conference, and the 1979 National NCSS Technical Work-Planning Conference.

### Charge 1

Several suggestions were made as to the best method of distribution of the course listing to colleges and universities. The committee agreed it should be done through the State Soil Scientist and/or Experiment Station Representative for NCSS. Contacts could be made jointly, or by either, depending on which they feel would be the most effective. The listing should be sent to all schools within each state that might enroll potential soil scientists.

A form letter and instructions will be provided, along with the course list. When the schools are contacted, they will be asked to identify those courses from the list offered at their institution. A request will be made for: (1) the School Bulletin course number, (2) a brief description of the course, and (3) whether it is an undergraduate or graduate level course.

A copy of the request will also be provided the NCSS representative at each cooperating school, so that they can provide assistance in seeing that the request is given proper attention.

Charge 2

After the responses are received, the committee will compile the information from the schools within each state. This information will be made available to: (1) agencies that employ soil scientists, (2) the raters who are involved in evaluating applicants for soil scientist positions, and (3) the Special Examining Unit in the National SCS office.

The committee feels this information will be of value and serve several purposes as follows:

1. The list of courses are those the committee feels are important for students in soil science.
2. The list would serve as a good reference for those in position to advise students in curriculum planning and course selection.
3. Provide guidance to schools in curriculum development.
4. Identify courses with mis-leading titles.

Charge 3

The states in the South region were surveyed concerning the kind of training guides in use for soil scientists. The response was excellent and all agreed more up-to-date guides are needed. Most, also, indicated they were in favor of keeping something similar to the "checklist" guide in the SCS National Training Handbook, but that it should be more comprehensive and have up-to-date references. Three states provided copies of updated training guides that they had developed for use in their soils training programs. The USDA Forest Service presently is using guides similar in content and format to the old SCS guide, but more up-to-date and modified for different grade levels. Sample copies of these plans are in the appendix of this report.

The committee agreed the best approach to the charge would be to develop a suggested training outline with emphasis on up-to-date activities and references. It was suggested by one that we should consider developing a complete training handbook. However, because of the work involved, most agreed this would not be feasible for this committee, even though the idea is good and it would be a useful tool in training and teaching.

The suggested training guide (attached to this report) is more comprehensive, and includes a number of items not on the old checklist guide. References have also been updated, using mainly the revised Soil Survey Manual and the National Soils Handbook. Other appropriate references could be added on a local basis.

This guide should be useful to party leaders and other supervisory soil scientists to aid in developing individual training plans for GS-5 through GS-9 (on equivalent) soil scientists, providing flexibility for selecting those items applicable to the training needs of the individual. No attempt was made to develop a standard format for individual training plans. It was felt this should be left up to the agency or state. Most will probably use a format similar to those in use by other disciplines within the agency.

Also, no attempt was made to estimate the time needed for individual training items. This would vary with individuals and would have to be worked out between each soil scientist trainee and their supervisor.

Other items will need to be added to this guide as it is tested. Also, other references would need to be added as appropriate--or as newer ones become available.

## Future Education Requirements and Training Needs in NCSS

In areas where soil surveys near completion, and active mapping is phased down, the soil scientist's role is changing. This subject was explored in depth by the 1980 Northeast and the 1982 West Soil Survey Work-Planning Conferences. Their reports summarize many thoughts and ideas, from various sources, concerning changes that can be expected in the next few years. Some agencies and states are already experiencing these changes. Some of the more significant changes mentioned are:

1. Fewer soil scientists due to constraints on funding.

2. More re-correlation and updating of older surveys.

3. Publishing more supplemental interpretative reports.

4. More emphasis on interpretations--both refining existing interpretations and developing those for new uses.

5. More field and on-site investigation and high intensity mapping.

6. More involvement in interdisciplinary work.

7. More training of other disciplines and soil survey data users.

8. More involvement with soils data bases and data storage systems.

9. More involvement in land use planning.

10. More involvement in inventoring and monitoring.

The soil scientist's job will be more demanding and with less routine work. This will require a broader base of technical training. Some of the areas where there will be a need for more training includes cartography, remote sensing, and air-photo interpretation, computer science, statistics, communication skills, botany and plant identification, economics, climatology, geology, geomorphology, and operations management.

There will continue to be a need for mapping skills and experience in the soil survey, either for updating or for refining surveys. Updating of older surveys will involve much recorrelation work and the soil scientist will need a good understanding of soil taxonomy, design of map units, and correlation procedures. Most of the anticipated activities of future soil scientists will require field soil survey experience. It is anticipated the soil scientist in the post mapping role should have at least the experience and competence of a party leader--or at least 3 or 4 years field experience.

Agency Training Courses

Some of the additional technical training can be provided by advanced degree work or from improved undergraduate soil science curriculum. However, much of the training must come from agency sponsored training courses.

Considerable attention has been given to the formal soils training courses in SCS. They are in the process of being revamped and coordinated into a package of "levels" as follows:

Level I Conservation For New Employees (Orientation) - 1 or 2 weeks and held in the state. The training includes 1 or 2 days of Soils training plus basic training from other disciplines. For all new employees.

Level II Basic Soil Survey - 2 weeks. Held at the NTC or in the state. For all soil scientists with 6 months to 2 years experience.

Level III Soil Correlation and Classification - 1 or 2 weeks. A middle level soils course. For soil scientists with at least 3 years experience.

Level IV Advanced Soil Correlation - 1 week. This is a new course now being developed. For party leaders and area or state soil scientists.

Level V Soil Science Institute - 6 weeks. For experienced party leaders or area and state staff soil scientists.

Other courses within SCS that are available for soil scientists are:

Basic Lettering - (Correspondence)
Soil Mechanics
Management, Levels II and III
Laboratory Data - Procedures (NSSL)
Laboratory Data - Use (NSSL)
Soil Interpretations (MNTC)
Training Methods (Supervisors)
Photo Interpretations and Application (WNTC)
Saline and Alkali Soils

Additional courses will, no doubt, be developed as there is a need for them.

Several have suggested the need for an operations oriented middle management course specifically for party leaders. This is an area of training needs that has been neglected. "Management - Level III" does not presently provide adequate training to prepare the party leader for the management responsibility of the field party. The "Training Methods" course is designed to provide basic training in administration and training techniques for supervisors at training locations. Many party leaders need this kind of training.

An item of significance to the SCS, is that the SCS Employee Development (Training) units from the NTC's are being combined into one unit and located at Fort Worth. This will have some impact on SCS conducted training. It is anticipated that more courses will probably be held in the states. Also, we anticipate that emphasis will be shifted more toward use of video or slide/taped courses--which can be made available in place of traditional classroom instruction. This is an area that must be explored more to see what the possibilities are in the soils training program. Possibly this can be a way of providing specialized training to field soil scientists. Also, it may prove useful in situations where there are only a few employees to be trained and a formal training course would be difficult to justify.

Other Concerns

A number of specific concerns were expressed by participatants at this conference, concerning training, that are worth of mention in this report, and considerations in the education and training program. These are:

1. Course list for soil science students. In addition to the basic soils courses, where we have an opportunity, we need to encourage students to take courses in geomorphology, geology, computor science, and statistics.

2. Selection of training locations for soil scientists. We must recognize that some party leaders are better "trainers" than others. We need to make use of these people to the fullest, whenever possible. Those that are less capable, should receive additional training to prepare them for this responsibility.

   Also, the training location is important. We need to try to select locations where there are facilities, like a university or a community college, nearby--so there is an opportunity for self-development. Then we need to encourage trainees to take advantage of thes facilities and opportunities.

3. Exposure to other disciplines early in the training program is very important. Trainees need to make contact with soil survey users, especially outside our agencies, including: community planners, health department officials, timber companies, etc. The trainees need to be informed of how the soil survey users think--the things they feel are important and how they use the survey.

4. Make training more of a challenge. Training plans must be flexible and tailored to each individual. Especially be sure we don't schedule those things the trainee already knows--or we risk causing them to become bored and lose interest in their work.

Reconunendations:

1. The suggested Training Guide be made available to party leaders and other supervisory soil scientists who have responsibility in training.

2. That consideration be given to redesigning the "Management - Level III" course at the NTC, so that it is more applicable to the management concerns of party leaders in the operation of the soil survey party.

3. That the NTC explore methods of providing training to field soil scientists through the use of video or slide/tape presentations.

4. That the committee not be continued.

5. That this report be accepted.

Committee Membership:

E. R. Blakely, Chairman
* D. D. Neher, Vice-Chairman
B. L. Allen
H. H. Bailey
L. C. Brockman
Talbert Gerald
* E. N. Hayhurst
W. A. Hill
Wayne Hudnall
A. G. Hyde
• Sunil Pancholy
H. F. Perkins
* R. P. Sims
B. J. Wagner

* Not present at the conference.

# TRAINING OUTLINE FOR SOIL SCIENTISTS

| Training Subject or Objective | Reference or Training Method |
|---|---|
| **A. Organization and Operations** | |
| 1. Organization of SCS*--local, state - national levels. | SCS* Employee Handbook |
| 2. History and mission of SCS*. | |
| 3. Relationship with SWCD's or other units of government. | |
| 4. The Soil Scientist's role - duties and responsibilities. | |
| 5. National Cooperative Soil Survey | The Nat'l Coop. Soil Survey of U.S. (Thesis by D. R. Gardner) |
| a. History and mission | Soil Survey Man.Chap. 1 |
| b. Agency Organization | NSH-Sec. 100 |
| c. Relationship with state Land-grant institutions, USDA Forest Service* and other federal, state and local agencies. | NSH-Sec. 202<br>SCS* Employee Handbook |
| d. Policies and Procedures | National Soils Handbook |
| e. Records and Reports | Timekeeping and Progress Systems Field Book |
| f. Schedules and APO's | NSH-Sec. 205,206 |
| g. Memorandums of under-standing | NSH-Sec. 202<br>Soil Survey Man.-Chap. 3 |

* Or other agency as appropriate.

| Training Subject or Objective | Reference or Training Method |
|---|---|
| **B. Methods and Procedures for Making Soil Surveys** | On-Job-Training |
| 1. Tools and Equipment - Use, care and maintenance. | Demonstrated by Experienced Soil Scientist |
| a. Soil angers, hydraulic probes, digging, and sampling tools such as spades, tubes, bars, and picks - with emphasis on safety procedures. | Soil Survey Man.-Chap. 3 |
| b. Abney level, clinometer, altimeter, and compass. | |
| c. Ink pens and lettering guides. | |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| 2. Maps and Aerial Photographs | Experienced Soil Scientist |
| a. Use of steroscope as aid to field work--to accurately interpret landforms and landscape features. | Nat'l Cartographic Manual<br>SCS Agrl. Hdbk. 294 |
| b. Knowledge of aerial photo interpretation in classifying and mapping soils. | |
| c. Knowledge of kinds of imagery and mapping base. | Soil Survey Man.-Chap. 3<br>Nat'l Cartographic Manual |
| d. Use of USGS quad sheets. | Soil Survey Man.-Chap.3 |
| e. Knowledge of soil map compilation and finishing. | Guides for Map compilation<br>Nat'l Cartographic Manual |
| f. Ability to produce legible maps, and join field sheets. | Soil Survey Man.-Chap. 7<br>NSH-Sec. 303.4 |
| g. Map measurement - Use of planimter, dotgrid or other methods. | Experienced Soil Scientist<br>Soil Survey Man.-Chap. 7 |
| 3. Pre-mapping Activities | NSH-Sec. 302 to 307.4<br>Soil Survey Man.-Chap. 3 |
| 4. Understanding of field mapping techniques. | Experienced Soil Scientist<br>Soil Survey Man.-Chap. 7 |
| a. Orientation<br>b. Photo interpretation<br>c. Traversing<br>d. Plotting soil boundaries | |
| 5. Soil Survey--field mapping - Developing competence in identifying and differentiating soils and recording soil profile characteristics. | Experienced Soil Scientist<br>Soil Survey Man.-Chap. 4 |
| a. Determination of profile development | |
| b. Soil horizons<br>(1) arrangement<br>(2) identification and nomenclature<br>(3) thickness and kind of boundaries | |
| c. Soil color | Munsell Color Book |
| d. Soil texture<br>(1) textural classes<br>(2) rock fragments and classes | Soil Sample "Standards" |
| e. Soil structure | |
| f. Soil consistence | |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| g. Chemical characteristics (1) soil reaction (2) salinity and sodicity | |
| h. Special features | |
| 5. Soil - Water relations | Soil Survey Man.-Chap. 4 |
| a. Soil - Water states | |
| b. Drainage classes | |
| c. Runoff classes | |
| 6. Soil permeability | Soil Survey Man.-Chap. 4 |
| 7. Soil erosion | Soil Survey Man.-Chap. 4 |
| a. Kinds of erosion | |
| b. Classes | |
| 8. Soil slope and relief | Soil Survey Man.-Chap. 4 |
| a. Surface configuration | |
| b. Slope length | |
| c. Slope aspect | |
| d. Slope gradient | |
| e. Slope classes | |
| 9. Identifty of other phases as appropriate. | NSH-Sec. 301.5 |
| a. Saline/alkali | |
| b. Flooding/overwash | |
| c. Stoniness/rockiness | |
| d. Depth/substratum | |
| 10. Use of convential and special symbol. | Soil Survey Man.-Chap. 6<br>NSH-Sec. 302.7(c) |
| 11. Mapping legends - How they are prepared and organized. | Soil Survey Man.-Chap.6<br>NSH-Sec. 302.7 |
| a. Identification legend | |
| b. Descriptive legend | |
| c. Procedures for keeping legends current and adding map units. | |
| 12. Understanding of concepts of toxonomic units and mapping units. | Soil Survey Man.-Chap. 5 |
| 13. How to design map units to meet the needs of the survey. | Soil Survey Man.-Chap. 5<br>NSH-Sec. 301.5 |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| 14. Understanding of soil/plant relationships--and use of key species in soil surveys--and plant identification. | Experienced Soil Scientist or Plant Scientist |
| 15. How to record and maintain fielo notes. | Soil Survey Man.-Chap. 7 |
| 16. How to describe a soil pcdon. | Soil Survey Man.-Chap. 4 |
| 17. How to determine composition of map units. | Soil Survey Man.-Chap. 7<br>State Guides<br>Experienced Soil Scientist |
| a. Methods of transecting<br>b. Site selection and layout of transects<br>c. Statistical analysis | |
| 18. How to photograph soils. | USDA-FS "Tips For Forest Photoyraphers"<br>NSH-Sec. 603.1<br>State Guides |
| 19. Soil mapping exercise - Map parcel of land, then accompany experienced soil scientist, and map same parcel. Carefully evaluate each degree of accuracy. | |
| 20. Do productive mapping in simple part of survey area, with close supervision cf experienced soil scientist - until mapping skills have been developed. | |
| C. Soil Interpretations - A working knowledge of policy and procedures | Experienced Soil Scientist<br>Soil Survey Man.-Chap. 11<br>KSH-Sec. 400 |
| 1. Understanding of soil properties that influerce soil behavior. | |
| 2. Special studies and assembly of basic data for interpretation. | NSH-Sec. 303.5 |
| 3. Computorized Soil Survey Interpretations. | NSH-Sec. 407 and Exhitits |
| a. SCS-SOILS-5's<br>b. Ratings Guide<br>c. SCS-SOILS-6's<br>d. Interpretative Tables | |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| 4. Capability classification | USDA SCS Agrl. Hdbk. 210<br>State Guides |
| 5. Engineering Uses and Soil Mechanics. | Nat'1 Engineering Handbook<br>PCA Soil Primer |
| 6. Rangeland | Nat'1 Range Handbook |
| 7. Recreation | NSH-Sec. 403.5 |
| a. Wildlife | Soils memo SCS-i4 |
| 9. Woodland | Nat'1 Forestry Manual |
| 10. Crop yields, collection, and assembly of data. | NSH-Sec. 407, 601 |
| 11. Hydrologic groups | |
| 12. K&T Factors | NSH-Sec. 603 |
| 13. Tax assessment | |
| 14. Soil loss prediction and USLE. | USDA-SCS Agrl. Hdbk. 537 |
| 15. Prime and unique farmlands. | LIM-Memo-3<br>NSH-Sec. 410 |
| 16. Hydric soils and Wetlands. | USDI FWS/OBS-79/31<br>State Guides |
| 17. Drainage | Nat'1 Engineering Handbook<br>State Guides |
| 18. Irrigation | Nat'l Engineering Handbook<br>State Guides |
| 19. How to develop soil potentials. | NSH-Sec. 404<br>State Guides |
| 20. How to develop resource data and display maps. | Nat'l Cartographic Manual<br>NSH-Sec. 600 |
| D. Soil Correlation and Classification | |
| 1. Understanding of Soil Classification theory and application. | Soil Taxonomy<br>NSH-Sec. 301 |
| 2. Understanding of Correlation procedures. | Soil Survey Man.-Chap. 10<br>NSH-Sec. 301 |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| 3. Kinds of mapping units | Soil Survey Man.-Chap. 5<br>NSH-Sec. 301.5 |
| a. Consociations<br>b. Complexes and associations<br>c. Undifferentiated groups | |
| 4. How to design and name mapping units. | Soil Survey Man.-Chap. 5<br>NSH-Sec. 301.5 |
| a. Series<br>b. Phases<br>c. Miscellaneous Areas<br>d. Higher Categories | |
| 5. Orders of Soil Surveys and levels of mapping intensities. | Soil Survey Man.-Chap. 2 |
| 6. Conventions for naming map units. | Soil Survey Man.-Chap. 5 |
| E. Soil Handbook | |
| 1. How to develop a soil handbook. | NSH-Sec. 302.7<br>NSH-Sec. 303.3 |
| a. Contents<br>b. Format | |
| 2. How to write a series description. | Soil Survey Man.-Chap. 10<br>NSH-Sec. 301.1<br>State Guides |
| 3. How to write a map unit description. | NSH-Sec. 302.7 |
| 4. Understanding of needed documentation. | NSH-Sec. 600 |
| a. Photographs<br>b. Notes and transect data<br>c. Lab data | |
| 5. Importance of testing mapping units and interpretations. | |
| 6. How to develop a general soil map, legend, and description of the units. | NSH-Sec. 303.6 |
| 7. How to prepare block diagrams. | SCS "Guide for Preparing Diagrams" |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| F. Soil Survey Manuscript | |
| 1. Relationship between Soil Handbook and Manuscript. | Experienced Soil Scientist<br>NSH-Sec. 603<br>State Guides |
| 2. Understanding of format and contents. | |
| 3. Responsibility for preparation. | |
| 4. Collection and organization of information. | |
| 5. Need for internal consistency. | |
| 6. Ordering Interpretative Tables. | NSH-Sec. 602 |
| G. Soil Investigations | |
| 1. Knowledge of Geomorphology. | Experienced Soil Scientist |
| a. Definitions and principles | Soil Survey Man.-Chap. 4 |
| b. Kinds of land forms | Soil Survey Man.-Chap. 8 |
| c. Features of the landscape | |
| d. Understanding of soil/ geomorphic relationships | |
| 2. How to sample soils for soil characterization including selection of the site. | Handbook of Soil Survey Investigations Field Procedures |
| 3. Procedures for collecting field data.<br>a. Soil moisture<br>b. Soil temperature<br>c. Bulk density | Handbook of Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples |
| 4. How to use field lab equipment.<br>a. Mechanical analysis<br>b. Base saturation<br>c. Salinity/Sodium<br>d. Calcium carbonate | Experienced Soil Scientist<br>State Guides |
| 5. How to interpret and use laboratory data. | Principles and Procedures for Using Soil Survey Laboratory Data - NSSL |
| 6. Understanding of Geology. | State/Local Geology maps |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| 7. Understanding of laboratory assistance available - NSSL and State. | NSH-Sec. 504.5 |
| 8. How to use SCS-SOILS-8's and 10's. | NSH-Sec. 506.3<br>NSH-Sec. 506.4 |
| 9. How to plan and initiate soil investigation studies. | NSH-Sec. 303.5 |
| 10. Benchmark Soils | NSH-Sec. 503 |
| H. <u>The Soil Scientist Role and Relationship of Soils With Other Disciplines</u> | |
| 1. Agronomy | Appropriate Specialist |
| 2. Biology (wildlife) | Appropriate Specialist |
| 3. Engineering | Appropriate Specialist |
| a. Soil Mechanics<br>b. Hydrology - Principles and interpretations<br>c. Engineerin_ classification systems<br>d. Engineering tests related to soils and soil interpretations | |
| 4. Forestry | Appropriate Specialist |
| 5. Range | Appropriate Specialist |
| 6. Recreation | Appropriate Specialist |
| 7. RC&D | Appropriate Specialist |
| I. <u>Resourse Conservation Planning - General Knowledge of:</u> | |
| 1. Principles and concepts. | DC or Experienced Planner<br>SCS Nat'l Resource Conserv. Planning Handbook and State supplements |
| 2. Technical Guide - contents and use. | Field Office Technical Guide |

| Training Subject or Objective | Reference or Training Methods |
|---|---|
| 3. Conservation practices. | |
| 4. Design and lay-out of practices. | |
| 5. Servicing Cooperators. | |
| 6. Development of basic farm or ranch plan. | |
| J. <u>Information and Promotion of the Soil Survey</u> | |
| 1. How to write a news release. | |
| 2. How to develop a slide presentation. | |
| 3. How to promote the Soil Survey. | |
| 4. How to work with Soil Survey users outside the Agency. | |
| a. Community Planners | |
| b. Sanitary/Health Officials | |
| C. Timber Companies | |
| K. <u>Career Development</u> | |
| Safety Procedures | Workshops |
| First Aid | Workshops |
| How to Communicate Effectively - speaking and writing. | Workshops (or outside self-improvement courses) |
| How to exhibit Professionalism. | Workshops |
| Awareness of Public Image. | Workshops |
| Ethics and Conduct. | Workshops |
| L. <u>Formal Training Courses</u> | |
| Professional Orientation | |
| Basic Soil Survey | |
| Soil Mechanics | |
| Management - Levels II and III | |
| Soil Interpretations | |
| Soil Correlation | |
| Laboratory Data - Procedures | |
| Laboratory Data - Use | |

## OTHER SUGGESTED REFERENCES


### GENERAL SOILS

The Nature and Properties of Soils. N. C. Brady. Latest Ed. MacMillan Company.

Soil-Plant Relationships. C. A. Black. John Wiley & Sons. 1968

Soil Chemistry. H. L. Bohn, B. L. McNeal, G. A. O'Connor. John Wiley and Sons. 1979

Soil Physics. Baver. Latest Ed.

Applied Soil Physics. R. J. Hanks and G. L. Ascroft. Springer - Verlag. 1980.

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Applications of Soil Physics. Daniel Hillel. Academic Press. 1980.

Physical Edaphology - The Physics of Irrigated and Non-irrigated Soils. Stering Taylor and Galylen Ashcroft. Freeman and Company. 1972.

An Introduction to Soils and Plant Growth. R. L. Donahue, R. W. Miller, J. C. Skickluna. Prentice-Hall, Inc. 1977.

Fundamentals of Soil Science. H. D. Foth. 1972. John Wiley and Sons.

Soil Fertility and Fertilizers. Tisdale and Nelson. MacMillan Publishing Company. 1975.

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Soil Conditions and Plant Growth. E. W. Russel. John Wiley and Sons. 1973

Aquatic Chemistry. Stumm and Morgan. John Wiley and Sons. Latest Ed.

Irrigation of Agricultural Lands. No. 11, 1967. Agronomy Monographs. 1967. American Society of Agronomy.

Irrigated Soils - Thorne and Peterson, 1954.

Aerial Photographic Interpretation - Lueder. McGraw-Hill Company. 1959.

SOIL CLASSIFICATION AND INTERPRETATIONS

Soil Genesis and Classification. S. W. Buol, F. D. Hole and R. J. McCracken. Iowa State University Press. 1980.

Soil Classification for Soil Survey. B. E. Butler. Claredon Press. 1980.

Soil and the Environment. Olson, Chapman, and Hall. Latest Ed.

Soil Surveys and Land Use Planning. Soil Science Society of America, Society of Agronomy. 1966.

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The Geography of Soils. 1976. D. Steila.

The Chemistry of Soil Constituents. D. J. Greenland and M. H. B. Hayes. John Wiley and Sons, 1978.

Planninq the Uses and Management of Land. Agronomy Monograph 21. American Societyof Aqronomy. Crop Science Society of America and Soil Science Society of America. 1978.

SOIL MICROBIOLOGY

Soil Microbiology. M. Alexander. John Wiley and Sons. 1977.

Microbial Life in the Soil. T. Hattou. 1973.

Soil Biochemistry. A. D. McLaren and G. H. Peterson. 1967.

Soil Microorganisms. Gray and Williams. Longman Pub. Co. 1974.

Introduction to Soil Ecosystems. B. M. Richards. Longman Pub. Co. 1974

Water Potential Relations in Soil Microbiology. Soil Science Society of America. sp. Pub. #9. 1981.

Microbial Ecology - Fundamentals and Applications. Atlas and Bartha. Adeison - Wesley Pub. Co. 1981.

Microbial Ecology. M. Alexander. John Wiley and Sons.

GEOLOGY AND GEOMORPHOLOGY

Glacial and Pleistocene Geology. R. F. Flint. John Wiley and Sons. Latest Ed.

Geomorphology - A. K. Dobeck.

Environmental Geology. Conservation, Land Use Planning, and Resource Management. Peter Faun.

Principles of Geomorphology - Thornbury. 1960.

Quaternary of the U.S. Wright and Frey. 1965.

Physical Geography. A. N. Strahler. John Wiley and Sons. Latest Ed.

Process Geomorpholoyy. D. F. Ritter. Wm. C. Brown Company. 1978.

The Study of Landforms. R. J. Small. Cambridge University Press. Latest Ed.

Sedimentary Environments and Facies. H. G. Reading. 1978.

Physical Geology. Longwell and Flint. John Wiley and Sons. Latest Ed.

# SUGGESTED COURSE LISTING FOR STUDENTS IN SOIL SCIENCE 1/

Since numerous questions have been raised as to the courses that should be allowed in each category, the committee offered the following:

<u>Soils courses</u> - general requirement

Introductory Soils, with laboratory
Soil Genesis and Classification
Soil- Morphology and Mapping
Soil Chemistry
Soil Physics
Forest and/or Range Soils
Soil Fertility and/or Fertilizers
Soil and Water Conservation
Drainage, Irrigation, and Erosion Control
Soil Mineralogy
Soil, Plant and Water Relations
Soil Geography
Soil Biology
Soil Microbiology
Soils and Land Use (Interpretations)
Soil Judging
Soil Micro-Morphology
Soil-Plant Analysis
Saline-Alkali Soils
Soil Mechanics

<u>Plant, Animal</u>

Plant Identification and Taxonomy
Dendrology
Silvicultural Practices
Plant Physiology
Plant Ecology
Crop Ecology
Wildlife Ecology
Introductory Botany
Field Botany
Introductory Biology
Introductory Zoology
Microbiology
Crop Management ("Crops")
Range and/or Pasture Management '(Habitat)
Plant Pathology (Forest, Crop, Range, Pasture)
Feeds and Feeding (Animal Nutrition)
Introductory Animal Science
Introductory Plant (Crop) Science

1/ Developed by Committee 3 of the 1980 Southern SSWP Conference.

Geology, Geography, Earth Science - modified from simply Geology

Introductory Historical Geology and/or Geography
Physical Geology
Physical Geography
Geomorphology/Physiography
Sedimentation/Sedimentology
Mineralogy/Crystallography
Hydrology/Ground Water Geology
Glacial Geology
Conservation/Land Use Planning
Aerial Photography/Photogrammetry/Remote Sensing
Stratigraphy
Meterology/Climatology/Atmospheric Science
Land Reclamation (including waste management)
Petrology/Optical Minerology
Geo-Chemistry
Clay Minerology
Urban Geology

Mathematics, Economics, Statistics, Computer Science - Computer Science added.

College Algebra (NOT remedial)
College Trigonometry or Pre-calculus Mathematics
Calculus
Agricultural and General Economics
Statistics
Computer Science

Chemistry, Physics

General Chemistry and laboratory
Organic Chemistry and laboratory
Physical Chemistry and laboratory
Quantitative/Qualitative/Analytical Chemistry
General Physics and laboratory

In addition, the following courses are considered to be highly desirable.

Communications/English - written and oral
Logic
Law (applied)
Management (organizational and personal)
Etymology
Finance (organizational and personal)

NOTE-Postscript from Committee chairman -
-A person not going to graduate school should probably be encouraged to have geology and/or geonorphology in preference to "additional" chemistry/physics courses. Those going to graduate school would probably want to emphasize chemistry/physics at the undergraduate level with geology/geomorphology taken at the graduate level.
HHB

U.S. Department Of Agriculture
Soil Conservation Service

MS-PS-6
11-79 (Rev.)
File Code PS-55-12-14

Soil Scientist Training Plan

NAME________________________________ TITLE________________________ GRADE_________

LOCATION ________________________________

| (1) Subject or Objective | (2) Subject Task Levels: Present | Req. for Pos. | At end Quarter 1 | 2 | 3 | 4 | (3) Method or Course | (4) Trainer or Facility | (5) Date: Begin | Complete | (6) Certification of Training Items Completed and Date Completed |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A. SOIL MAPPING | | | | | | | | | | | |
| 1. Kinds of Soil Surveys | | | | | | | | | | | |
| 2. Aerial Photographs and Their Interpretation for surveys | | | | | | | | | | | |
| 3. Identification and Morphology of Soil | | | | | | | | | | | |
| a. Soil Color Munsell notations | | | | | | | | | | | |
| b. Soil Texture | | | | | | | | | | | |
| c. Soil Structure-grade, site, type | | | | | | | | | | | |
| d. Consistence | | | | | | | | | | | |
| e. stone or Gravel Content | | | | | | | | | | | |
| f. Acidity and Alkalinity | | | | | | | | | | | |
| g. Special Features - concretions, fragipans, etc. | | | | | | | | | | | |
| h. Soil Genesis | | | | | | | | | | | |
| i. Drainage - color, mottling position | | | | | | | | | | | |
| 4. Soil Descriptions | | | | | | | | | | | |
| a. Pedon - horizon designations, color, texture structure consistence, horizon boundary, pH, etc | | | | | | | | | | | |

Appendix 2

Appendix 2

DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
DIVISION OF CONSERVATION
TRAINING FOR NEW SOIL SCIENTIST
(Kentucky)

| TRAINING SUBJECT AND KNOWLEDGE OR PROFICIENCY REQUIRED | REFERENCE OR METHOD OF TRAINING | RECORD OF TRAINING COMPLETED, DATE, TRAINER, AND REMARKS | | | |
|---|---|---|---|---|---|
| | | DATE | SUPERVISOR NAME | KNOWLEDGE LEVEL | 2YEAR LEVEL |
| I. ORIENTATION | | | | | |
| 1. DNREP-Division of Conservation | Soil Scientist III | | | | 4 |
| 2. Organization | | | | | 4 |
| 3. Soil Conservation Districts | | | | | 4 |
| a. Mission & History of SCD's | | | | | 4 |
| 4. Relationship with other agencies | | | | | 3 |
| 5. Div. of Conservation & SCS Cooperative Agreement | | | | | 4 |
| 6. Organization & History of SCS | Party Leader | | | | |
| a. How SCS works with Conservation Districts | | | | | 3 |
| b. Farm Conservation Planning | | | | | 2 |
| c. Conservation District Farm Cooperators | | | | | 2 |
| d. District Cooperative Agreement | | | | | 2 |
| e. National Cooperative Soil Survey | | | | | 3 |
| II. NAT[redacted]OPERATIVE SOIL SURVEY | | | | | |
| 1. [redacted]ation of soil survey party | | | | | 4 |
| 2. [redacted]f surveys | | | | | 4 |
| 3. [redacted] of published soil survey | | | | | 4 |
| 4. [redacted] published soil survey | | | | | 4 |
| SOI[redacted]Y-FIELD INVESTIGATIONS | | | | | |
| 1. [redacted]rvey mapping legend | | | | | 4 |
| 2. [redacted]assification | | | | | 4 |
| 3. [redacted] & geomorphology | | | | | 4 |
| 4. [redacted]nterpretations & use of stereoscope | | | | | 4 |
| 5. [redacted]mpling | | | | | 4 |
| 6. [redacted]nation of profile development | | | | | 4 |
| 7. [redacted]xture-field determination | | | | | 4 |
| 8. [redacted]lor | | | | | 4 |
| 9. [redacted]e & wetness | | | | | 4 |
| 10. [redacted] classes and estimations | | | | | 4 |
| 11. [redacted]lasses, land form and relief | | | | | 4 |
| 12. [redacted]otes | | | | | 4 |
| 13. [redacted]soil mapping | | | | | |
| 14. [redacted]ource Soil Survey | to Texas | | | | 4 |

# COMPREHENSIVE TRAINING OUTLINE

Name: ____________________

Location: ____________________

FY-

| Training Item | Trainer | l Begi | e Comp. | Trainer's Remarks/ Initials | Supervisor Signature 'Proficiency * *Certification* |
|---|---|---|---|---|---|
| I. Soil surveys - field mapping<br>A. Kinds of surveys<br>B. Photo interpretation (in-depth training in this area to include use of the stereoscope)<br>C. Texture identification, field tests<br>D. Determination of profile development<br>E. Soil color<br>F. Permeability estimation<br>G. Slope measurement<br>H. Erosion estimation<br>I. wetness<br>J. Alkali and salinity estimation<br><br>Emphasize the need for being able to recognize broad landscape and positions within the landscape as preliminary soil boundaries. This should be done during the training in field mapping. This should also be tied in later with item VI, soil investigations below "Geomorphology--land forms."<br><br>II. Soil surveys<br>A. Inking maps<br>B. Joining maps<br>C. use of scs-19 forms<br>D. Aerial photography<br>E. Stereoscopy<br>F. Map measurement<br>G. Plant identification (grass)<br>H. Plant composition and density (grass)<br>1. Ecology of plants and soils (grass)<br>J. Crops: corn, tobacco, cotton, soybeans, etc. | | | | | |

| Training Plan<br>Entrance Level Soil Scientist*<br>5/7 | Training Method<br>Individual Trainer<br>Assigned | Tr… Pl… Hrs | …ing Time & …d Date | Comp… Hrs | …tes …ted Date | Comments |
|---|---|---|---|---|---|---|
| Organization & Operation | Self-Selected Readings | | | | | |
| 1. Mission and Charter of th FS, historical background present and future activities and operations | 'The Forest Service - A Study In Public Lan Management," by Glen O. Robinson | 40 | | | | |
| 2. The Soil Scientist's role In the Forest Service; to develop an understanding of duties and responsibil ities related to resource management and planning. | Synopsis of the soils Program for Region 2 | 40 | | | | |
| 3. Relationship between the USDA-Soil Conservation Service and the USDA-Forest Service concerning National Cooperative Soil Surveys. | Roles of the SCS and FS. USDA Oct. 1976 - WO Task Force Report. Interim Direction | 40 | | | | |
| Methods and Procedures for Making Soil Surveys: | On-Job Training | | | | | |
| 1. Tools and Equipment Use | | | | | | |
| a. Soil Augers (both ban and power)- how to use without danger of personal Injury. | Demonstration by experienced Soil Scientist | 1 | | | | |

esigned for employee's who have ıd no previous experier : In il survey/: il management.

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Appendix Z

## COMMITTEE IV - SOIL SURVEYS AND LAND ASSESSMENTS

Chairman: Glenn E. Kelley
Vice Chairman: John Soileau
Members:

| | |
|---|---|
| R. B. Brown | H. J. Kleiss |
| George J. Buntley | B. J. Miller |
| Steve Coleman | O. D. Philen |
| J. L. Dreissen | J. A. Phillips |
| B. L. Harris | W. E. Richardson |
| Ray Hoyum | |

### Committee Charges

1. Evaluate for the Southern Region:

   A. Current Taxation Systems which utilize soil surveys

   B. Current Land Evaluation Systems which utilize soil surveys

2. Identify successes and failures of taxation systems utilizing soil surveys.

### Committee Approach

A questionnaire was sent to all states in the South Region requesting information to address the charges of this committee. In addition, four states outside the region (New York, Ohio, South Dakota and Vermont) were contacted to provide some outside input for comparison. These states were used as examples in the 1980 Committee Report where their programs were described.

The last report from this commiteee in 1980 was very comprehensive and included information gathered throughout the United States. This report was used as a reference in this year's committee activities. This year's committee however, concentrated its activities mainly in the southern region with some helpful comments received from the states listed above.

### Response to Charges

Charge #1. Evaluate for the southern region: (a) current taxation systems which utilize soil surveys, and (b) current land evaluation systems which utilize soil surveys.

Nearly all land evaluation systems which utilize soil surveys in the southern region are fur the purpose of taxation. Response received from each state is as follows:

ALABAMA

Legislation has been recently passed allowing a system of current use valuation for tax assessment of real property. This newly enacted law is scheduled for initiation on October 1, 1982. Agricultural land is one of the four major classes of property differentiated on the basis of current use for tax assessment purposes. Ten soil groups, based largely on land capability plus other considerations such as soil fertility, soil depth, subsoil permeability, and water relationships, are identified within the Agricultural Land Category. Productivity ratings of good, average, poor, or nonproductive are assigned to each soil grouping. Separate productivity ratings are determined by the tax assessor for agricultural and forest land uses.

ARKANSAS

Land evaluation program for taxation is in effect.

Provisions

- Soils combined into productivity groups by county. (System previously used land capability classes).
- Yield data from SCS publications tabulated for each productivity group.
- Weighted average yields computed for individual crops by productivity group.
- Yields (SCS) adjusted with Crop Reporting Service average yields.
- Extension crop budgets used to obtain net returns to land.-
- Apply severance tax statistics to timber.
- Income levels tabulated for crops for each productivity group.
- Appropriate capitalization rate applied to obtain appraise value for each productivity group.
- Data then overlayed on soils map (map used by assessors to tax parcels of land).
- System is used statewide where soil surveys are completed. An alternate system is used for counties lacking soil surveys.

Good Points

- Use of soil survey as a base.

Problems

- The use of land capability classes was previously a problem but has been revised to the use of productivity groups.
- Productivity groups now need to be developed by major land uses. Presently all land uses are treated equally.

## FLORIDA

Legislation enacted about 1975 to check comparability of agricultural land assessments amony counties.

### Provision?

- State monitors and spot checks county assessments to be sure they are evaluating at 100% of market value.
- Cropland and woodland evaluation is based on potential productivity of the soils.

### Good Points

- Soils information recognized as best basis for evaluating agricultural land.

### Problems

- System using soils is not required because all counties do not have the same level of soils information.

## GEORGIA

None used

## KENTUCKY

Legislation was passed about 1970 permitting counties to develop a program of taxing farmland on its agricultural value. The state suggested procedure is based on cost-returns by crops and is very complex. For this reason it has not beer, used effectively. The Kentucky Department of Revenue is currently working with the University of Kentucky, Extension Service to improve the system for assessing the agricultural value of farmland.

### Provisions

- The system being developed for trial use will be based on soil capabilities and crop yield statistics from individual counties. When the methods have been worked out this system will be recommended for all counties to use.

### Good Points

- Still being tested.

### Problems

- Soil survey maps are at a different scale from land ownership maps.
- Soil surveys are not available for all counties in the state.

## LOUISIANA

Legislation to provide for tax equalization based on land use was passed in 1976.

### Provisions

- Open land and forest land are treated separately and differently.
- Open land tax is based on land capability classes I through IV. Classes above IV are considered the same as IV.
- Forest land tax is based on woodland suitability groups 1 through 4.

### Good Points

- Provides some tax equalization.
- Slows urbanization rate.

### Problems

- Cropland and pastureland taxed equally which is not always fair.
- Need a more desirable base for openland than capability classes.
- Conifers and hardwood are taxed equally which is not always fair.

## MISSISSIPPI

Legislation passed in 1980 to provide for uniform property taxation and has been implemented in some counties.

### Provisions

- System to tax agricultural land according to its current use value.
- Based on land capability and five year average crop yields.
- Crop yields to be arrived at by data from Crop and Livestock Reporting Service and Mississippi Department of Agriculture and Commerce.
- Incorporated average production costs and typical management practices for primary crops by major soil areas.
- Woodland evaluated by a separate rating system based on site index and local experience.

### Good Points

- Still to be tested.

### Problems

- Still to be tested.

## NORTH CAROLINA

Legislation passed in 1975 to provide for equalization of land evaluation for taxation. Reassessed every 5 years based on market value.

### Provisions

- Soil productivity using corn as an indicator crop is one of the factors in the land evaluation equation.
- Soil surveys are frequently used in the process but not specifically required.

### Good Points

- Provides for an objective and equitable basis of land evaluation.

### Problems

- Yields were reduced about 25% in the equalization process as compared with soil survey reports.

## OKLAHOMA

No legislation.

Productivity Index using soil surveys is being developed by private consultants for each soil in the state. The PI's will be used as one element in a formula for equalizing taxes. Tax commission is in the process of converting to a method of assessing taxes using productivity indexes.

## SOUTH CAROLINA

Tax assessment legislation passed in 1977.

### Provisions

- Soil maps enlarged to match tax maps.
- Ratings of 1 to 7 assigned to each map unit for openland and for woodland.
- Values are assigned to each rating using yields and site index.

### Good Points

- Equalized tax assessment within and between counties.

### Problems

- Arriving at yield levels that are acceptable to state farm agencies.
- Net income was used in assigning values, but would have to rework per acre value as prices of products, land and supplies change; so are now using yields.

hone presently used. A system was tried in the early 1970's using net income to land, labor and capital, but it was discontinued due to local political pressures.

## TEXAS

An ag land use evaluation system is currently being used. However, there is no direct use of soil surveys or yield data to arrive at productivity. Generalized soil maps are used to develop productivity areas (resource areas). Values are assigned to productivity areas based on market value and land use.

## VIRGINIA

Legislation is in effect to provide for preferential use tax.

### Provisions

- Counties are encouraged to develop a preferential use tax for agricultural. horticultural, forest and open land.
- Capability classes are used as a basis for agricultural? horticultural and open land. A range of values are assigned to each capability class.
- The basis for woodland assessment is assigned by the Virginia Oivision of Forestry where individual site assessments are made.
- Approximately 50% of the counties in the state are using this system.
- Landowners must apply annually for this tax reduction and the system includes a five year roll back.

### Good Points

- System appears to be working reasonably well.

### Problems

- Hope tc bring about revisions in the system to reflect productivity potential similar to the Agricultural Land Evaluation and Site Assessment (LESA) System developed by SCS.

  The LESA System is being tested in Virginia and appears to be working satisfactorily for developing land use regulations to promote the protection of important farmland.

Charge #2. Identify successes and failures of taxation systems utilizing soil surveys.

A. Successes - Of all the land assessment systems evaluated by this committee, those using soil surveys and some measure of soil productivity, with or without capability groupings, appear to be the most successful and equitable. Soil surveys provide the key basis for most successful systems.

b. A number of problems or suggested improvements were received by the committee. These are as follows:

1. A successful land evaluation program requires a method for educating the land owners in understanding and utilizing the system. In Ohio for example, the cooperative extension service has developed a publication to provide a step-by-step procedure including sample forms for filing under Ohio's "Current Agriculture Use Value Taxation Program. It is important that tax assessors have a working knowledye of soil survey and procedures in making soil surveys. Also county commissioners must understand the purpose and basis of procedures in the land evaluation system.

2. Planned evaluation systems must be flexible to permit special adjustments within states and even counties to allow for unique problems. For example in New York the climatic zone was dropped due to lack of sufficient data to draft accurate climatic zones on a state map. Presently climate in the system is reflected by the soils. Natural Time content of the soils has been added as an additional parameter in agricultural land evaluation. Two additional flooding frequency classes have been added for alluvial soils to allow for lower agricultural value assessments in certain watersheds.

3. Frequently a method of accounting for spot symbols may be needed such as stones, rock outcrops and wet spots. Possibly where certain spot symbols are used, an area comparable to a minimum size delineation for the survey area, 2 or 3 acres for detailed surveys, could be dropped to an appropriate lower evaluation group.

4. Yields shown on SCS form-5's and in soil survey reports are based on a high level of management while in most agriculture value systems the yields (which form the basis for an index number) are supposedly for "average management". Arriving at yield estimates for "average" management has caused some problems. Generally some factor of the high management yields has been used. This may not be completely satisfactory.

5. Grouping soils and providing a single assessed valuation for each group is not satisfactory to some people (particularly soil scientists). In other words a soil with an index of 91 has the same valuation as a soil with 100. When in fact it is probably more like a soil having an 89 index that is in a lower evaluation group. Possibly a curve could be used to read directly the valuation with the index of each soil rather than grouping soils.

## RECOMMENDATIONS

1. The Committee recommends that the extension service, SCS, and other agricultural agencies provide strong guidance in the development of state and local land evaluation systems. If appropriate the Agricultural Land Evaluation and Site Assessment (LESA) System should be presented as an example. This program offers complete guidelines but still leaves flexibility for individual state and county use.

2. The Committee continues to recommend a vigorous and systematic program of yield data collection and revision of soil interpretations to reflect these more accurate data. Alabama has developed a yield data collection system in conjunction with progressive soil surveys that should be shared with other states.

3. The use of capability classes alone is discouraged for land assessment and taxation purposes.

4. Any land evaluation program should be developed slowly to allow for local adjustments as needed. Permit time to work out both technical and political problems.

5. In some areas where crop yields are used to group soils for taxation purposes, consider the possibility of subgrouping based on degree of management (cost).

6. The activities of this committee as a part of the Southern Regional Work-Planning Conference should be discontinued since research needed to address the charges has been completed. However, since more states are beginning to use soil surveys in land assessment it is suggested that this activity continue to be monitored, possibly by the South National Technical Center and the committee reactivated if needed.

An additional subject that surfaced during the group discussions to be considered for future committee action is the development of an effective system for collecting crop yield data by mapping unit.

COMMITTEE V - EVALUATION OF HYDRAULIC CONDUCTIVITY DATA

| | | |
|---|---|---|
| Committee Membership: | C. T. Hallmark, Chairman | Ron Paetzold |
| | Charles McElroy, Vice-Chairman | Warren Lynn |
| | Everett Cole | Bill Smith |
| | Jimmy Frie | Lawson Spivey |

$$\frac{Q}{At} \propto \frac{\Delta E}{\Delta L}$$

TABLE 1

HYDRAULIC CONDUCTIVITY CLASSES*

| CLASS | SAT. HYDR. COND. | |
|---|---|---|
| | UM/SEC | CM/HR |
| HIGH | | |
| VERY HIGH | >100 | '36 |
| HIGH | 10-100 | 3.6-36 |
| MODERATE | | |
| MODERATE | 1-10 | 0.35-3.6 |
| MODERATELY LOW | 0.1-1 | 0.036-0.36 |
| LOW | | |
| LOW | 0.01-0.1 | 0.0036-0.036 |
| VERY LOW | <0.01 | <0.0036 |

* FROM CHAP, 4, "NEW" SOIL SURVEY MANUAL

TABLE 2

FACTORS FOR CONVERSION OF COMMON UNITS OF HYDRAULIC CONDUCTIVITY TO THE SI UNIT

| CONVERT FROM | TO UM/SEC | MULTIPLY BY |
|---|---|---|
| INCHES/HOUR | | 7.06 |
| INCHES/DAY | | 0.294 |
| CM/SEC | | 10000 |
| CM/HOUR | | 2.78 |
| CM/DAY | | 0.116 |

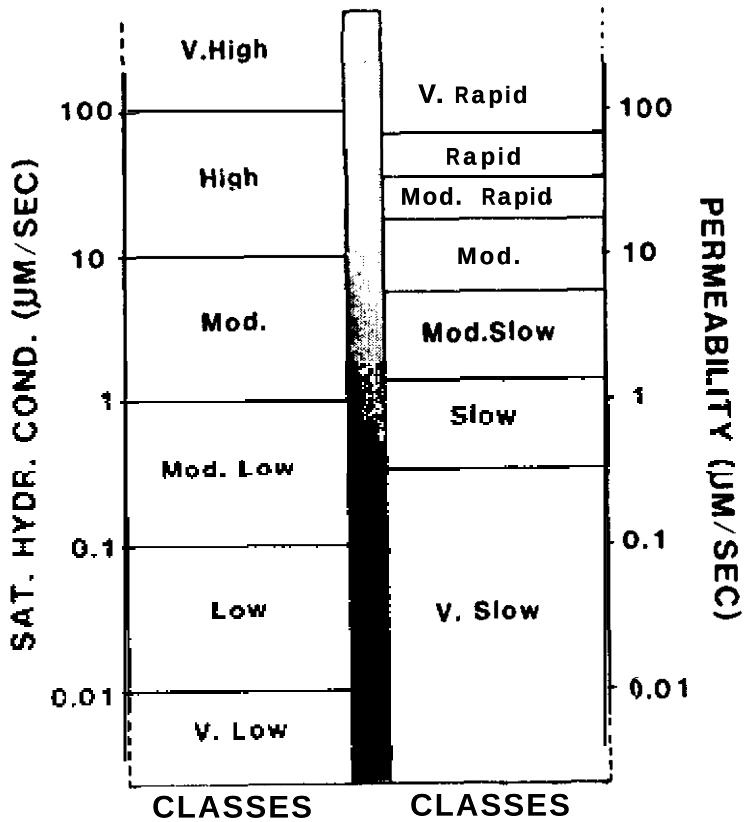


FIGURE 1. COMPARISON OF HYDRAULIC CONDUCTIVITY AND PERMEABILITY CLASSES.

The variable Q is the quantity of water moving across a cross-section of soil (A) in a given time (t). AE is the change in energy of the water system along the distance AL. Units for each variable are given below:

$$Q = um^3$$
$$A = um^2$$
$$t = sec$$
$$AE = \text{millipascals}$$
$$L = um$$

The expression $\frac{Q}{At}$ has the units of um/sec, which is the velocity of water moving through the soil. Therefore, $\frac{Q}{At}$ can be replaced by velocity, v

$$v \propto \frac{\Delta E}{\Delta L}$$

The energy of the water system can be expressed as a sum of the energy due to gravity (Az) and the energy due to matrix pressure or tension (Ah). These variables Az and Ah can replace AE to give:

$$v \propto \frac{\Delta z + Ah}{AL}$$

To make the expression an equation, hydraulic conductivity (K) is introduced as a proportionality factor.

$$v = K \frac{Az + \Delta h}{AL}$$

The eauation can be used to calculate both unsaturated and saturated hydraulic conductivity. However, since we are concerned only with saturated hydraulic conductivity, in saturated systems Ah equals zero so the equation for saturated hydrualic conductivity reduces to

$$v = K \frac{\Delta z}{\Delta L}$$

Use of the equation can be best illustrated by the laboratory core method for determining saturated hydraulic conductivity. The method involves passing water through a saturated soil core. The rate of water movement passing through the core is measured and assigned as the velocity (v). The length of the soil core is ΔL while the length of the core plus the height of water above the core is Az. The value of the saturated hydraulic conductivity (K) is then calculated. It is important to note that K is only equal to the rate of water movement when the soil is still saturated but the height of water above the core is equal to zero, a condition which is seldom met in nature. However, K allows one to calculate the rate of water movement when the soil moisture system is defined.

Saturated hydraulic conductivity is not a constant but varies with the system. Likewise, hydraulic conductivity for unsaturated soil is highly dependent upon the soil tension and pore volume which is filled with water. Figure 2 illustrates the dependency of hydraulic conductivity upon water content of the soil using data of Nielson, et al. (1973). As indicated in the figure, hydraulic conductivity in saturated soil is higher than in unsaturated soil.

Saturated hydraulic conductivity is not normal distributed but follows a log-normal distribution (Mason, et al., 1957). The significance of log-normal distribution is, that a simple averaging of hydraulic data results in a value that is higher than the true mean. In order to calculate the mean of several observations of hydraulic conductivity, it is necessary to average the logarithm of the values then take the antilog. A mean which is calculated in this fashion is called a geometric mean. This calcualtion is easily performed on a hand calculator and is illustrated in Table 3.

Saturated hydraulic conductivity is highly variable. Values obtained for several sites within a single series may vary by 100-fold as can be noted in Carlisle et al.. (1976, 1981) for the Bt horizon of the Riviera series (Arenic Glossaqualf). The variability of saturated hydraulic conductivity is noted in Table 4 for a selected horizon in three soils. The Astatula (Typic Quartzipsamments, hyperthermic, uncoated) Cl horizon is generally of sand or fine sand texture. The coefficient of variation (CV), a parameter that increases as variation increases, is low and all the sites observed would be placed into the very high hydraulic conductivity class. The spodic horizon (Bh) of the Myakka series (Aeric Haplaquod, sandy, siliceous, hyperthermic) is a relatively dense horizon of sand or loamy sand texture that seasonally perches water. Further, expression of the spodic horizon is variable and this variability is noted in the relatively high (33%) coefficient of variation for the saturated hydraulic conductivity. Sites ranged from high to moderately low in hydraulic conductivity class, although the mean saturated hydraulic conductivity indicates a class of moderate. The argillic horizon (Bt) of the Riviera series (Arenic Glossaqualf, loamy, siliceous, hyperthermic) ranges in texture from sandy loam to sandy clay loam and exhibits tonguing. The argillic horizon seasonally perches water and of the five sites considered, values for saturated hydrualic conductivity ranged over 100-fold and fell in three different classes. The coefficient of variation was 43%. The great variability in saturated hydraulic conductivity among sites causes one to question the confidence with which this parameter can be estimated for a series. Mason et al. (1957) evaluated the probability of correctly assigning a site to one of seven permeability classes based on five cores from a site. They found that the probability of being correct is about 30%, i.e., the soil unit would be placed in the correct class only 3 out of 10 times. Of course, probability of correct class placement for a series is improved as the number of sites is increased. Tables 5 and 6 illustrate this point by showing the range defined at the 80% and 95% confidence level for the

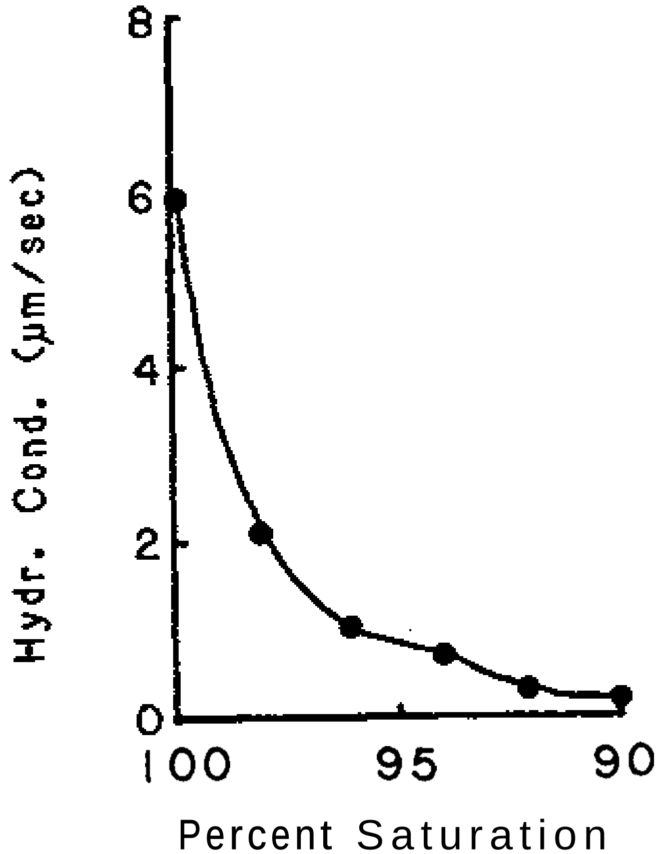


FIGURE 2. HYDRAULIC CONDUCTIVITY AS A FUNCTION OF PERCENT SATURATION AT 30 cm DEPTH FOR THE PANOCHE SERIES (NIELSON, ET AL. 1973).

TABLE 3

CALCULATION OF GEOMETRIC MEAN OF SATURATED HYDRAULIC CONDUCTIVITY (K)

| K | 10K* | LOG 10K |
|---|---|---|
| UM/SEC | | |
| 0.6 | 6 | 0.7782 |
| 8.1 | 81 | 1.9085 |
| 4.2 | 42 | 1.6232 |
| 14.0 | 140 | 2.1461 |
| 1.6 | 16 | 1.2041 |
| TOTAL | | 7.6601 |

MEAN OF LOG 10K = 7.6601/5 = 1.5320

ANTILOG 1.5320 = MEAN OF 10K = 34.0

$$\text{MEAN } K = \frac{34.0}{10} = 3.4 \text{ UM/SEC}$$

*K SHOULD BE MULTIPLIED BY A CONSTANT TO RAISE ALL VALUES ABOVE 1. THIS AVOIDS USE OF NEGATIVE LOGARITHMS. ANTILOG VALUE MUST THEN BE DIVIDED BY THE SAME CONSTANT.

TABLE 4

COMPARISON OF SATURATED HYDRAULIC CONDUCTIVITY
STATISTICS FOR THREE SOIL HORIZONS*

| | ASTRATULA C1 | MYAKKA BT | RIVIERA BT |
|---|---|---|---|
| NO. SITES | 7 | 6 | 5 |
| HIGHEST K, UM/SEC / LOWEST K, UM/SEC | 206 | 10.56 | 7.2 0.05 |
| K (ARITH.) UM/SEC | 170 | 7.9 | 1.9 |
| K (GEOM.) UM/SEC) | 160 | 4.5 | 0.64 |
| CONDUCTIVITY CLASS | VERY HIGH | MODERATE | MOD.LOW |
| % CV | 5 | 33 | 43 |

*EACH SITE REPRESENTS AVERAGE OF THREE CORES, FROM CARLISLE ET AL, (1978, 1981) AND CALHOUN ET AL, 1974).

## TABLE 5

### RANGE* OF SATURATED HYDRAULIC CONDUCTIVITY (K) FOR MYAKKA BH HORIZON AT 80% CONFIDENCE LEVEL

| No, Site | Range<br>um/sec | Possible Classes |
|---|---|---|
| 2 | 0.3-71 | 3 |
| 3 | | 2 |
| 4 | 1.6-13 | 2 |
| 5 | | 2 |
| 10 | 1.9-11 2.6-7.8 | 1 |

* Geometric mean of K = 4.5 um/sec. Each site represents average of three cores,

## TABLE 6

### RANGE" OF SATURATED HYDRAULIC CONDUCTIVITY (K) FOR MYAKKA BH HORIZON AT 95% CONFIDENCE LEVEL

| Ho, Sites | Range<br>um/sec | Possible Classes |
|---|---|---|
| 3 | 0.2-105 | 4 |
| 4 | 0.6-34 | 3 |
| 5 | 0.9-22 | |
| 10 | | 3 |
| 15 | 2.2-9.1 1.8-11 | 2 1 |

* Geometric mean of K = 4.5 um/sec. Each site represents average of three cores.

saturated hydraulic conductivity for the Bh horizon of the Myakka series. At the 95% confidence level, a total of 15 sites (3 cores per site) would be necessary in order to correctly place the series into the moderate hydraulic conductivity class. Three sites give a range in values which span four classes. Working at the 80% confidence level, fewer than 10 sites are needed to correctly place the series into the proper hydraulic conductivity class. Three sites give a range which includes only two classes. Due to the great amount of variability in saturated hydraulic conductivity, it is recommended that the 80% confidence level be used. Higher levels of confidence require an intensity of data gathering which would severely limit one's ability to address but a few series.

Assessment of saturated hydraulic conductivity at levels above the series has been shown to be promising. King and Franzmeier (1981) evaluated hydraulic conductivity based upon soil morphological and genetic information. They found that by combining texture, parent material, and genetic horizon information, permeability classes could usually be identified as one of two classes using a minimum of five sites and 2-4 replicates per site. This approach is illustrated in Table 7 where the saturated hydraulic conductivity for the spodic horizon was calculated for the great groups of Haplaquods and Haplohumods. Means of saturated hydraulic conductivity for the Haplaquods and Haplohumods indicate classes of moderate and high, respectively. In both cases a sufficient number of sites were included to give class placement at the 80% confidence level. The findings of Table 7 confirm field interpretations that have generally indicated that Haplaquods have slower water movement than Haplohumods. Admittedly, all series classified as either Haplaquods or Haplohumods will not fall into the respective classes but mean saturated hydraulic conductivities of selected horizons at higher classification levels can be used as a benchmark for adjusting classes for series.

Numerous methods have been developed to measure saturated hydraulic conductivity. Several of the methods are presented by Klute (1965), and Boersma (1965 a, b). Bouma et al. (1982) compared a number of available methods. The three methods which are best adaptable to the needs and resources of the soil survey are given in Table 8. The double tube and auger hole methods are both field techniques. Each is restricted to specific conditions: the double tube method is used when the measurement is of a horizon above the water table while the auger hole method is for below water table horizons. Unfortunately, the double tube method requires an investment of about $650 for apparatus and only one determination can be performed per half-day. The auger hole method, however, is relatively fast, and requires a minimum investment but can only be used in horizons below a water table. The restrictions and expense associated with these two methods are the prime reasons that most data available on soil horizons have been secured using the laboratory core method. Although field methods would be preferred, the laboratory method offers an avenue by which data can be generated and is useful in assigning classes to saturated hydraulic conductivity. In general, variability in the laboratory method is reduced as the diameter of the core is increased.

TABLE 7

COMPARISON OF SATURATED HYDRAULIC CONDUCTIVITY OF SPODIC HORIZONS'

| | HAPLAQUODS | HAPLOHUMODS |
|---|---|---|
| NO. SITES | 24 | 17 |
| GEOM. MEAN (UM/SEC) | 5.27 | 51.7 |
| % CV | 51 | 39 |
| CONDUCTIVITY CLASS | MODERATE | HIGH |

* DATA FROM CARLISLE ET AL. (1978 & 1981)

TABLE 8

COMPARISON OF SELECTED METHOD OF MEASURING SATURATED HYDRAULIC CONDUCTIVITY

| | DOUBLE TUBE | AUGER HOLE | LABORATORY CORE |
|---|---|---|---|
| ACCURACY | FAIR | FAIR | FAIR |
| TIME REQUIRED | SLOW | RAPID | RAPID |
| COST | HIGH | LOW | LOW |
| RESTRICTIONS | ABOVE WATERTABLE | BELOW WATERTABLE | - |
| REFERENCE | BOERSMA, (1965B) | BOERSMA, (1965A) | KLUTE (1965) |

Based upon the variability discussed previously, it is recommended that a minimum of three replicates be used per site, regardless of the method selected. Further, the number of sites necessary to establish the hydraulic conductivity class for series should be a minimum of five. All averaging of hydraulic conductivity data should be geometric. However, as the variability increases (this is reflected in % CV), the number of sites would need to be increased. A realistic goal would be to correctly assign the hydraulic conductivity class at the 80% confidence level.

B. Recommendations pertaining to Charge 1.

A review of firm, field or laboratory-measured data on saturated hydraulic conductivity revealed that sufficient data to soundly place series into hydraulic conductivity classes are lacking. Therefore, it is recommended that each state initiate a concerted effort to obtain additional data on saturated hydraulic conductivity. To accomplish this, each state is encouraged to have initially at least one survey party collect hydraulic conductivity data by the augar-hole technique. This technique is recommended because it is a field method, inexpensive, and rapid (up to 6 sites per day). This method is discussed by Boersma (1965a); experiment station cooperators are encouraged to provide support for and expertise in this endeavor. Additionally, a limited number of alyses are possible through the Soil Mechanics Laboratory, South National Technical Center. Because of the high degree of variability, it is recommended that three observations per horizon be made and sufficient sites be utilized to allow estimation of the geometric mean at the 80% confidence level.

Charge II. To enumerate soil properties which affect saturated hydraulic conductivity.

A. Response to Charge II.

Literature indicates that saturated hydraulic conductivity is principally influenced by the following properties of the soil: pore size distribution, pore continuity, pore geometry, clay mineralogy and adsorbed cations on the soil clays. Unfortunately, these para-meters cannot be easily evaluated in the field during soil survey activities. However, there are morphological features which can be noted and can be used as keys for field estimation of hydraulic conductivity classes. These properties include texture, structure, bulk density, wetness mottles or color, and a knowledge of the shrinkswell properties of the soil. Today, texture is not thought to be as important of a parameter as in previous times (Uhland and O'Neal, 1951). Likewise, bulk density alone is a poor indicator of saturated hydraulic conductivity (Mason, et al., 1957) but becomes more meaningful when combined with texture and structure. The soil pores range in size from microscopic to macroscopid. Under saturated flow conditions, the amount of water passed through the soil is a function of the relative number of pores in each size range and the total number of pores. Since the larger pores conduct water under saturated conditions at a faster rate than the smaller pores, these larger pores take on greater meaning when estimating saturated hydraulic conductivity. Bouma et al. (1979) have shown the great importance of recognizing large continuous pore space when evaluating saturated flow as most of the water moves via these voids. Many of these large continuous pores exist between soil structural units and although the ped interiors may be fine-textured, saturated flow may be relatively rapid due to the large pores. If soil structure is poorly defined or if large pores are discontinuous, then saturated flow is reduced. Within the humid areas of the Southeastern Region, one might expect indications of wetness (low chroma or hues grayer than 10YR) to develop just above or in horizons where the saturated flow of water is slow. Such horizons should be considered as having a low or very low hydraulic conductivity class and would likely include clays and silty clays with little inter-pedal void space and most fragipans. Classes of high hydraulic conductivity will commonly include sands, loamy sands, and highly structured sandy loams; in each case, saturated flow may be along interped surfaces or within the ped. Presence of clay bridges or illuvial organic matter within the ped would be expected to decrease the saturated flow, and although the texture is relatively coarse, such soil horizons may properly be in a moderate class. It is most expedient to indicate that the moderate classes are intermediate in soil properties as previously designated.

Such guidelines as discussed in the previous paragraph should be considered provisional and subject to field evaluation. At the present time, it is not possible to quantify hydraulic conductivity in terms of morphological soil properties and efforts to refine our knowledge in this area are needed.

B. Recommendations pertaining to Charge II.

Because of the critical timing of this report coinciding with the "switch-over" to hydraulic conductivity classes, it is recommended that efforts within each state be made to insure uniformity in assignment of classes. Soils on which hydraulic conductivity data are available should be used as guides to class placement. Permeability and/or infiltration studies do not normally provide data upon which classes can be defined; however, such studies do give guidance to relative ranking of series. Morphological properties should be carefully evaluated and considered. To aid in interstate agreement of class designations, guidelines within each state should be developed with assistance from the SNTC.

## Concerns and Suggestions

During the course of committee meetings and general discussions, a number of concerns and suggestions was expressed. Some are given below as a matter of record.

1. Proper description of water movement in soils in which water transmission properties may change due to management. Crusting, rooting, and "plow pans" serve as examples.

2. Use of three rather than six classes of hydraulic conductivity are sufficient. If so, three, rather than six classes, would greatly ease the uncertainty of designations.

3. Use of classes without attachment of a value for hydraulic conductivity. It was noted that publishing values for hydraulic conductivity often leads to misuse of the values.

4. Use of identical terms to describe general classes and individual classes. It was noted that this practice leads to confusion and the need for different terms at the general and individual class levels was noted.

5. Identification within the Soil Survey Reports of those soil properties which are highly variable. The need to alert the user of the degree of confidence associated with each measured or estimated soil property was noted. Possibly, a separate section within each report should address the degree of confidence one can estimate appropriate soil properties.

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Boersrna, L. 1965b. Field measurcrment of hydraulic conductivity above a water table. In C. A. Black (ed.) Methods of soil analysis, Part I. Agronomy 9:234-252, Am. Soc. of Agron., Madison, Wis.

Bouma, J., A. Jongerius and D. Schoonderbeek. 1979. Calculation of saturated hydraulic conductivity of some pedal clay soils using micro-morphometric

## COMMITTEE VI - CLASSIFICATION AND INTERPRETATION OF SOILS WITH BEDROCK

Charges:

Assemble existing information and data on soils with bedrock which will furnish guidelines to:

1. Quantify criteria and definitions used to determine "soft" and "hard" bedrock.
2. Determine relationship of "soft" and "hard" bedrock as compared to paralithic and lithic contacts.
3. Recommend needs and methods for classifying and interpreting soils with thin layers of bedrock.
4. Suggest ways to emphasize the presence of bedrock (in published soil surveys).

Committee Membership:

T. E. Calhoun, Chairman
J. F. Brasfield, Vice-Chairman
Gilberto Acevedo
S. W. Buol
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Definitions Presently Used:

Lithic contact1

A lithic contact is a boundary between soil and coherent underlying material. Except in Ruptic-Lithic subgroups the underlying material must be continuous within the limits of a pedon except for cracks produced in place without significant displacement of the pieces. Cracks should be few, and their average horizontal spacing should be 10 cm or more. The underlying material must be sufficiently coherent when moist to make hand digging with a spade impractical, although it may be chipped or scraped with a spade. If it is a single mineral, it must have a hardness by Mohs scale of 3 or more. If it is not a single mineral, chunks of gravel size that can be broken out must not disperse during shaking for 15 hours in water or in sodium hexametaphosphate solution. The underlying material considered here does not include diagnostic soil horizons such as a duripan or a petrocalcic horizon.

Paralithic contact'

A paralithic (lithiclike) contact is a boundary between soil and continuous coherent underlying material. It differs from a lithic contact in that the underlying material, if a single mineral, has a hardness by Mohs scale of F3. If the underlying material is not a single mineral, chunks of gravel size that can be broken out disperse more or less completely during 15 hours of endoverend shaking in water or in sodium hexametaphosphate solution and, when moist, the material can be dug with difficulty with a spade. The material underlying a paralithic contact is normally a partly consolidated sedimentary rock such as sandstone, siltstone, marl, or shale, and its bulk density or consolidation is such that roots cannot enter. There may be cracks in the rock, but the horizontal spacing between cracks should be 10 cm or more.

Bedrock[4]

The solid rock that underlies soil and other unconsolidated material or that is exposed at the surface.

C horizons or layers[2]

Horizons or layers, excluding hard bedrock, that are little affected by pedogenic processes and lack properties of 0, A, E, or B horizons. Most are mineral layers, but limnic layers, whether organic or inorganic, are included. The material of C layers may be either like or unlike that from which the solum presumably formed. A C horizon may have been modified even if there is no evidence of pedogenesis.

Included as C layers are sediments, saprolite, and consolidated bedrock that when moist can be dug with a spade. Some soils form in material that is already highly weathered, and such material that does not meet the requirements of A, E, or B horizons is designated C. Changes not considered pedogenic are those not related to overlying horizons. Layers having accumulations of silica, carbonates, or gypsum or more soluble salts are included in C horizons, even if indurated, unless these layers are contiguous to an overlying genetic horizon; then they are a B horizon.

R Layers:[2] Hard Bedrock

Granite, basalt, quartzite, and indurated limestone or sandstone are examples of bedrock that are designated R. The bedrock of an R layer is sufficiently coherent when moist to make hand digging with a spade impractical, although it may be chipped or scraped with a spade. Some R layers can be ripped with heavy power equipment. The bedrock may contain cracks, but these are few enough and small enough that few roots can penetrate. The cracks may be coated or filled with clay or other material.

"r" Weathered or soft bedrock'

This symbol is used with "C" to indicate layers of soft bedrock or saprolite, such as weathered igneous rock; partly consolidated soft sandstone, siltstone, or shale; or dense till that roots cannot enter except along fracture planes. The material can be dug with a spade.

Soft Bedrock[3]

Soft bedrock is likely to be sufficiently soft or fractured so that excavation can be made with trenching machines, backhoes, or small rippers and other equipment common to construction of pipelines, sewerlines, cemeteries, dwellings or small buildings, and the like.

Hard Bedrock[3]

Hard bedrock is likely to be sufficiently hard or massive to require blasting or special equipment beyond what is considered normal in this type of construction (i.e., pipelines, sewer lines, cemeteries, dwellings or small buildings, and the like).

UWB[3]

Unweathered bedrock. Texture term to be used in lieu of textures.

WB[3]

Weathered bedrock. Texture term to be used in lieu of textures.

Discussion of Definitions

The greatest difficulties with the present definitions are their (1) lack of continuity, and (2) the assumptions individuals have had to make in applying the definitions.

(1) The lack of continuity is easily seen if the definitions for paralithic contact, C horizons, "r", and soft bedrock are compared.

The material underlying a paralithic contact is to be continuous and coherent, soft enough when moist that it can be dug with difficulty with a spade, it will disperse after a period of shaking, and its bulk density or consolidation is such that roots cannot enter except along cracks which must have a horizontal spacing of 10 cm or more. Some examples of materials that qualify under this definition are given. These include partly consolidated sedimentary rock, but the definition does not exclude other qualifying materials.

C horizons or layers exclude hard bedrock, and include sediments, saprolite, and consolidated bedrock that when moist can be dug with a spade. It is usually assumed that this definition is meant to include materials underlying a paralithic contact, however, since the criteria for dispersing with shaking, bulk density such that roots cannot enter, etc. is not carried through, it is conceivable that all materials underlying a paralithic contact may not qualify as C horizons.

"r" is a symbol used with "C" to indicate layers of soft bedrock or saprolite; partly consolidated soft sandstone, siltstone, or shale; or dense till that roots cannot enter except along fracture planes. The material can be dug with a spade. It has been the convention to use the "r" to indicate materials underlying a paralithic contact however, the definition for "r" only allows for bedrock or dense till. Any other materials underlying a paralithic contact are excluded.

Soft bedrock is defined on the basis of ease in excavation. Some material underlying a paralithic contact however, are excluded since they may not be classed as Bedrock. It should also be noted that highly fractured hard bedrock is covered by the definition of soft bedrock.

This same process could be followed for the definitions of Lithic contact, R layers, and Hard bedrock. Although the difficulties in applying these definitions are not great, the inconsistencies between definitions are still there.

(2) Some of the assumptions that have been made in applying the definitions are alluded to in the preceeding discussion. Again, the greatest difficulty is with the term paralithic and soft bedrock, and the symbols "r" and C horizon.

It is commonly assumed that materials underlying paralithic contacts are either soft bedrock or dense till.

It is commonly assumed that the symbol r is used exclusively to indicate the presence of soft bedrock or dense till or in other words the materials underlying a paralithic contact.

As presently defined, soft bedrock may include Cr materials (soft bedrock or dense till) or highly fractured hard bedrock.

These assumptions cause difficulty when making soils interpretations. It is a common practice in completing soils interpretation records to always indicate the presence of bedrock when a paralithic contact or a Cr horizon is indicated under the USDA Texture column. This in turn causes one of the limiting factors for many of the interpretations to be "depth to rock". This is totally inappropriate if the Cr material is not bedrock, as would be the case with dense till..
There is also a problem in that highly fractured hard bedrock or excavatable hard bedrock must be entered as soft under the hardness column to get the proper interpretations.

A final problem with the soils interpretation record is that where bedrock either hard or soft is encountered in the soil profile the symbol UWB for unweathered bedrock, or WB for weathered bedrock must be entered under the USDA Texture column for the appropriate layer. It should by now be evident that weathered or unweathered does not necessarily correspond with hard or soft or paralithic.

Committee Recommendations

1. The following are recommended changes in the definitions:

Lithic contact'

A lithic contact is a boundary between soil and coherent underlying material. Except in RupticLithic subgroups the underlying material must be continuous within the limits of a pedon except for cracks produced in place without significant displacement of the pieces. Cracks should be few, and their average horizontal spacing should be 10 cm or more. The underlying material must be sufficiently coherent when moist to make hand digging with a spade impractical, although it may be chipped or scraped with a spade. Chunks of gravel size that can be broken out must not, when air dry or drier, slake within 24 hours when placed in water. The underlying material considered here does not include diagnostic soil horizons such as a duripan or a petrocalcic horizon. (A hardness by Mohs scale of 3 or more when the rock is composed of a single mineral may be used to help define a lithic contact.)

Paralithic contact'

A paralithic (lithiclike) contact is a boundary between soil and continuous coherent underlying material. It differs from a lithic contact in that gravel size chunks of the underlying material that can be broken out when air dry or drier will slake within 24 hours when placed in water. When moist, the material can be dug with difficulty with a spade. The material underlying a paralithic contact is commonly a partly consolidated sedimentary rock such as sandstone, siltstone, or shale, and its bulk density or consolidation is such that roots cannot enter. There may be cracks in the rock, but the horizontal spacing between cracks should be 10 cm or more.

C horizons or layers2

Horizons or layers, excluding hard bedrock, that are little affected by pedogenic processes and lack properties of 0, A, E, or B horizons. Most are mineral layers, but limnic layers, whether organic or inorganic, are included. The material of C layers may be either like or unlike that from which the solum presumably formed. A C horizon may have been modified even if there is no evidence of pedogenesis.

Included as C layers are sediments, saprolite, unconsolidated bedrock and other geologic materials that commonly will slake within 24 hours when air dry or drier chunks are placed in water and, that when moist can be dug with a spade. Some soils form in material that is already highly weathered, and such material that does not meet the requirements of A, E, or B horizons in overlying horizons. Layers, some of which will not slake in water having accumulations of silica, carbonates, or gypsum or more soluble salts are included in C horizons, even if indurated, unless these layers are contiguous to an overlying genetic horizon; when they are a B horizon.

R Layers[2] Hard Bedrock

Granite, basalt, quartzite, and indurated limestone or sandstone are examples of bedrock that are designated R. Air dry or drier chunks of an R layer when placed in water will not slake within 24 hours and the R layer is sufficiently coherent when moist to make hand digging with a spade impractical, although it may be chipped or scraped. Some R layers, when fractured, can be ripped with heavy power equipment. The bedrock may contain cracks, but these are few enough and small enough that few roots can penetrate. The cracks may be coated or filled with clay or other material.

Soft Bedrock[3]

Soft bedrock is likely to be sufficiently soft so that excavations can be made with trenching machines, backhoes, or small rippers and other equipment common to construction of pipelines, sewerlines, cemeteries, dwellings or small buildings, and the like. It can be dug with difficulty when moist with a spade.

Hard Bedrock[3]

Hard bedrock is likely to be sufficiently hard or massive when not fractured to require blasting or special equipment beyond what is considered normal in this type of construction (i.e., pipelines, sewer-lines, cemeteries, dwellings, or small buildings). If fractured it can be excavated.

2. A new definition is proposed for "r" with the addition of the term "Paralithic Materials":

r - Paralithic Materials

This symbol is used with "C" to indicate soft bedrock or other materials into which roots cannot enter except along fracture planes, but which will slake within 24 hours when air dry or drier chunks are placed in water; examples include saprolite, consolidated soft sandstone, siltstone, shale and dense glacial till. The material when moist can be dug with difficulty with a spade. (These materials commonly underlie a paralithic contact.)

3. The symbols UWB and WB should be eliminated since the determination of weathered or unweathered is not significant to the interpretations. Instead the presence of bedrock will be indicated by writing in the words HARD BEDROCK or SOFT BEDROCK as appropriate.

4. On the soil interpretation record an additional term is needed to describe bedrock. That term is Fractured. This would eliminate the need to classify excavatable fractured hard bedrock as SOFT in order to obtain the correct interpretations. An additional blank should be added under the bedrock column for Fractured.

If the rock is fractured the horizontal spacing of the fractures will be entered in this column. If the rock is not fractured this column will contain a dash. If the soil contains both soft bedrock and hard bedrock, and the hard bedrock occurs at depths of less than 60 in the profile, the "depth" column will indicate the depth to the hard bedrock.

| | BEDROCK | |
|---|---|---|
| DEPTH | HARDNESS | FRACTURED |

5. The committee did not have a major problem in dealing with layered bedrock. The primary recommendation was to describe the layer as any other layer in the soil is described. That is, for example:

   46 to 67 inches - hard fractured limestone bedrock; easily excavated with small equipment; fractured at intervals of 25 to 45 cm.
   67 to 80 inches - dark gray (10YR 3/1) sand loam....etc.

The layer would be indicated on the interpretation record as bedrock in the USDA TEXTURE column and the underlying layers would also be indicated. The interpretations would still be limited by the features of the bedrock as appropriate.

6. To emphasize the presence of bedrock in published surveys the recommendations are to use pictures, and or block diagrams to illustrate the presence of rock and to write about the influence of rock on soils interpretations.

7. It is recommended that the Director of Soils consider incorporating these changes into Soil Taxonomy, chapter 4 of the Soil Survey Manual, the National Soils Handbook, and into the Soils Interpretation Record (SCS-SOILS-5 form).

a. It is recommended that this committee be discontinued.

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[1] Soil Taxonomy
[2] Soil Survey Manual - Chapter 4, May 1981
[3] National Soils Handbook
[4] The Glossary of Terms for Soil Survey Publications

## COMMITTEE VII - CALCULATION AND EVALUATION OF K FACTORS

### Use of Soils Data in the Application of the Universal Soil Loss Equation

Chairman: D. A. Lietzke
Vice-Chairman: DeWayne Williams
Members: James Box, R. T. Fielder, D. R. Lowe, R. Rehner, Hubert Byrd, L. C. Geiger, J. C. Meetze, Mary Collins, D. E. Lewis, C. Mutchler

Committee Charges

1. Problem areas of soil data and K factors
2. Problem areas of soil data and T factors
3. Soil slopes from mapping units and their application to the USLE
4. Evaluate criteria used for calculating K factors for sandy soils and recommend adjustments to result in positive values.

### COMMITTEE REPORT

Charge 1. Problem areas of soil data and K factors.

K factors have been generated by runoff studies for key soils and the data extrapolated to soils with little or no data by use of the Soil-erodibility Nomograph developed by W. A. Wischmeier ARS SWC. Five parameters are used to predict erodibility. They are: percent silt plus very fine sand, percent sand greater than 0.10 millimeters, organic matter content, structure, and permeability.

Increased availability of laboratory data has allowed the silt plus very fine sand and organic matter content parameters to be entered with greater precision in the nomograph. Structure can usually be readily identified and consistently agreed on by soil scientists. The permability parameter is mainly estimated.

It appears that silt plus very fine sand is the major contributing parameter to the K factor. Data from the SSIR serves for Southern States was used by DeWayne Williams to generate K factors.

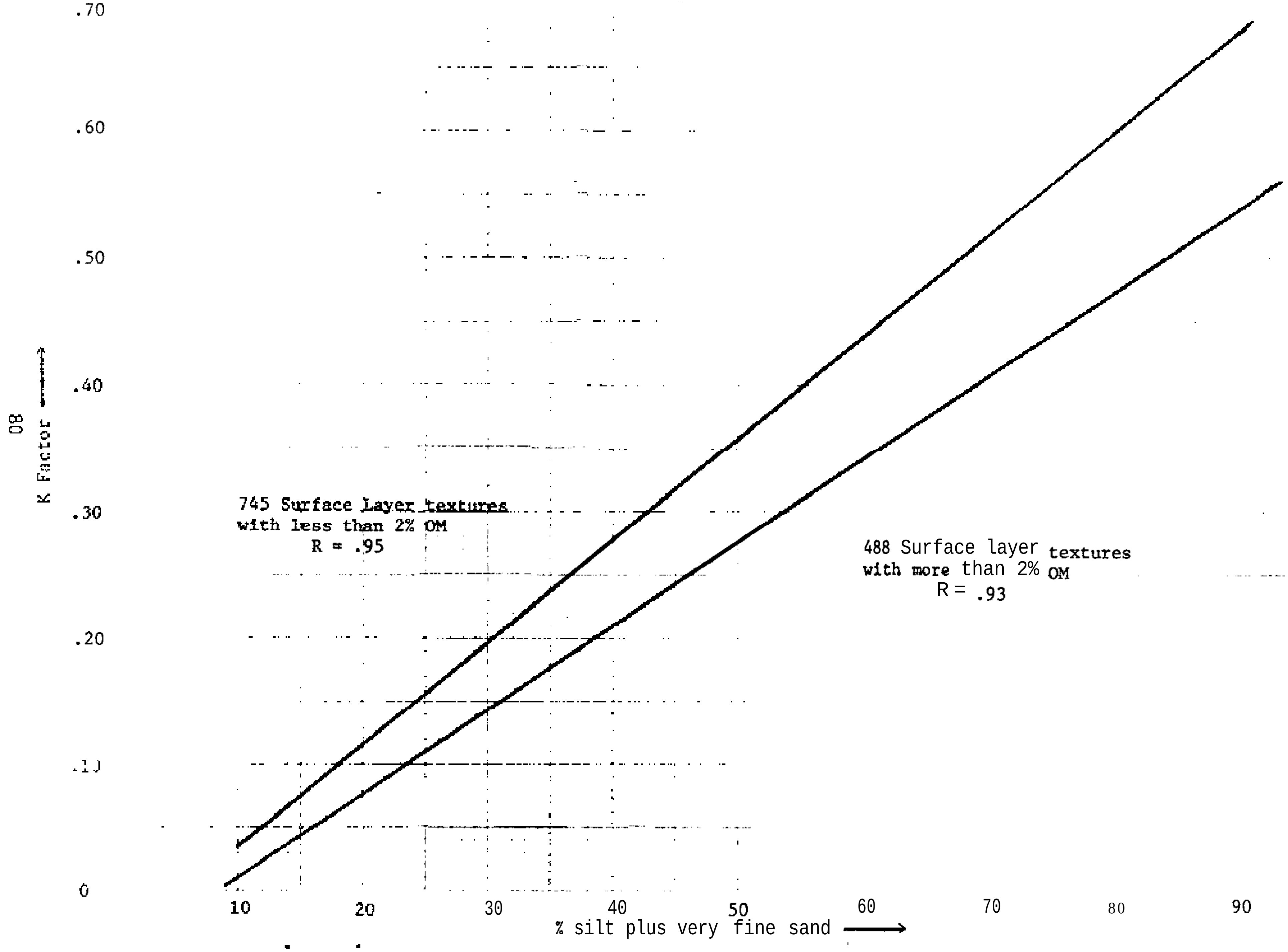
This data was then plotted, Figure 1, to show the relationship 'between percent silt plus very fine sand and the K factor.

Problems

1. K factors for high silt and VFS soils are currently shown on SCS-5's appear to be too low and those of very sandy soils are too high, Appendix I.

2. Many sandy soils have negative K factors. This is due to too much weighing of silt + VFS. With sandy soils organic matter is more important.

Figure 1 Relationship of percent silt plus very fine sand to the K factor for surface soil textures in the Southern Region.



3. Adjustments for coarse fragments effect on K factors perhaps did not receive the attention it should have during the Nomograph development but the STSC soils #1601 does contain a method for coarse fragment compensation.

4. When lab data is available, the K factor generated does not ThT K facfoonlyhindicimateaonoctiamoveagmenorforna giveCiteon. always fall within a tolerance range of the SCS5 K factor for a given USDA texture. This is because the silt + VFS component within a given USDA texture can vary. Furthermore the other particle size parameters of percent sand greater than 0.10 mm and percent coarse fragments also can vary.

Recommendations

1. The Wischmeier Nomograph appears to do a reasonable job of providing estimates of K values a measure of estimating

withir tttC so easvey aa r.(+)Tj 1.35 T20873.73 0 Td5(Furthermole, thpubliy sd Kmm)Tj 0.81 T-20
texturr ttto cabrscaudrr fobroadeieplannidinpurposeson.3.
Whenoctiab damm+3.

Lithic contact - All Lithic subgroups
inert fragipans'72 feet thick
petrocalcic horizon within 40 inches
petrogypsic horizon " " "
duripan " " "
paralithic contact " " "
more than 5% plinthite " " "
horizon with less than
0.10 in/in AWC " " "

2. Have a sliding T factor to flag these erosion sensitive soils, or adopt a resource value to indicate the effect of erosion on decreasing the value of the soil resource base. Then targeted funds could be used to expedite the changes necessary to slow the rate of change by management means and also by educational means to change farmers attitudes about soil erosion. Appendix II contains such a proposal.

Charge 3. Soil Slopes and their Application to the USLE

Problems

1. Most map unit delineations contain complex slopes, with different slope lengths and gradients.

2. Estimation of slope length and gradient from a soil map or a topographic map can lead to a very poor LS value estimate. This poor estimate can be more important than the K factor in the USLE.

3. Many conservationists do not have a basic understanding of the USLE. This equation does a good job in predicting annual loss from simple slopes. Most management units do not have simple slopes or are composed of only one soil. Conservationists tend to want one value from a field which can have a wide ranoe of possible values that can be generated by the USLE.

Reconendations

1. Provide SCS planners with tools and training needed to determine actual slope lengths and gradients, especially for erosion sensitive soils and soil delineations containing a complex slope pattern.

Charge 4. Evaluate criteria for K factor calculations for sandy soils and recommend adjustments to result in positive values.

Recommendations

Where VFS + silt is less than 10%, which usually gives negative K factors, K values should be 0.01. For VFS + silt values of 10 to 20%, most K values should lie between 0.01 and 0.10 until actual experimental data should indicate otherwise.

Appendix I

**From Data Folders**

| Series | Texture | K | si + vfs | s >vfs | OM | Structure | Perm |
|---|---|---|---|---|---|---|---|
| Allen | fsl | | | | | | |
| | fsl | | | | | | |
| | L/sil | | | | | | |
| Amagon | Sil | | | | | | |
| | fsl | | | | | | |
| | sil | | | | | | |
| | fsl | | | | | | |
| | sil | | | | | | |
| Amarillo | ls | | | | | | |
| | fs | | | | | | |
| | scl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | scl | | | | | | |
| | fsl | | | | | | |
| | lfs | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | scl | | | | | | |
| | scl | | | | | | |
| | fsl | | | | | | |
| | scl | | | | | | |
| Astatula | fs | | | | | | |
| Austin | sic | | | | | | |
| | sic | | | | | | |
| | c | | | | | | |
| | sic | | | | | | |
| | sic | | | | | | |
| | SIC | | | | | | |
| Axtell | vfsl | | | | | | |
| | fsl | | | | | | |
| Bladen | | | | | | | |

| Series | Texture | K | si + vfs | s >vfs | OM | structure | Perm |
|---|---|---|---|---|---|---|---|
| Bowie | fsl | .46 | 61 | 35 | 1.0 | 2 | 3 |
| | fsl | 51 | 64 | 33 | 0.5 | 2 | 3 |
| | ufsl | 50 | 71 | 26 | 1.9 | 2 | 3 |
| | ufsl | 58 | 80 | 17 | 2.4 | 3 | 3 |
| | fsl | 28 | 46 | 51 | 4.0 | 3 | 3 |
| | Sil | 54 | 76 | 10 | 1.8 | 3 | 3 |
| Calhoun | si | 71 | 89 | 2 | 1.5 | 3 | 5 |
| | si | 60 | 86 | 3 | 1.7 | 1 | 5 |
| | sil | 59 | 84 | 2 | 1.7 | 2 | 5 |
| | si | 73 | 88 | 2 | 1.4 | 4 | 5 |
| | sid | 44 | 69 | 5 | 1.4 | 4 | 5 |
| | sil | 57 | 78 | 5 | 1.6 | 3 | 5 |
| | sil | 62 | 82 | 5 | 1.7 | 3 | 5 |
| | sil | 61 | 78 | 4 | 0.5 | 3 | 5 |
| Cecil | sl | 19 | 35 | 54 | 2.7 | 2 | 3 |
| | fsl | 22 | 37 | 51 | 1.5 | 2 | 3 |
| | fsl | 22 | 35 | 54 | 1.2 | 2 | 3 |
| | Cl | 16 | 31 | 39 | 2.4 | 3 | 3 |
| | fsl | 34 | 60 | 30 | 3.1 | 2 | 3 |
| | ℓ | 27 | 45 | 42 | 1.6 | 2 | 3 |
| | sl | 15 | 29 | 63 | 3.1 | 2 | 3 |
| | ls | 23 | 33 | 62 | 0.8 | 2 | 3 |
| | fsl | 33 | 58 | 30 | 2.7 | 2 | 3 |
| Commerce | sil | 60 | 87 | 3 | 1.5 | 1 | 4 |
| | Sil | 53 | 83 | 1 | 1.4 | 1 | 4 |
| | sil | 36 | 64 | 10 | 1.8 | 2 | 4 |
| | fsl | 46 | 56 | 41 | 0.5 | 2 | 4 |
| Crider 80-33-l | sil | 44 | 78 | 6 | 3.1 | 2 | 4 |
| 70-24-56 | sil | 45 | 71 | 9 | 1.4 | 2 | 4 |
| 70-24-55 | Sil | 48 | 78 | 5 | 2.3 | 2 | 4 |
| 70-71-Z | sil | 57 | 82 | 6 | 1.7 | 2 | 4 |
| 70-71-l | sil | 55 | 83 | 3 | 1.9 | 2 | 4 |
| Crowley | Sil | 55 | 81 | 3 | 2.4 | 2 | 6 |
| | Sil | 61 | 81 | 6 | 1.5 | 2 | 6 |
| | Sil | 67 | 87 | 3 | 1.7 | 2 | 6 |
| | sil | 68 | 88 | 5 | 2.0 | 2 | 6 |
| | si | 63 | 88 | 1 | 1.8 | 1 | 6 |
| | sil | 68 | 88 | 1 | 1.6 | 2 | 6 |
| Dalhart | fsl | 24 | 34 | 55 | 1.4 | 3 | 3 |
| | fsl | 22 | 31 | 56 | 1.0 | 3 | 3 |
| | lfs | 19 | 28 | 67 | 0.6 | 2 | 3 |
| | fsl | 41 | 55 | 35 | 0.9 | 3 | 3 |
| | fsl | 25 | 38 | 52 | 0.9 | 2 | 3 |
| | fsl | 18 | 29 | 58 | 0.9 | 2 | 3 |
| Darco | Ifs | 17 | 28 | 67 | 0.2 | 1 | 3 |
| Decatur | cl | 32 | 56 | 16 | 1.4 | 3 | 3 |
| | sil | 29 | 57 | 24 | 2.9 | 2 | 3 |
| | cl | 26 | 54 | 16 | 1.8 | 2 | 3 |
| | ℓ | 25 | 46 | 29 | 1.0 | 2 | 3 |
| | sicl | 16 | 43 | 12 | 1.0 | 2 | 3 |
| | Sil | 40 | 64 | 17 | 1.0 | 2 | 3 |

| Series | Texture | K | si + vfs | | |
|---|---|---|---|---|---|
| Decatur | ℓ | | | | |
| | cℓ | | | | |
| | sicℓ | | | | |
| | sil | | | | |
| Dennis | ℓ | | | | |
| | sil | | | | |
| | sil/ℓ | | | | |
| | sil | | | | |
| Dothan | ls | | | | |
| | ls | | | | |
| | ls | | | | |
| | fsl | | | | |
| | fsl | | | | |
| | sl | | | | |
| Duval | vfsl | | | | |
| | fsl | | | | |
| | lfs | | | | |
| Eden | sic | | | | |
| | sic | | | | |
| Enders | fsl | | | | |
| | ℓ | | | | |
| | fsl | | | | |
| | ℓ | | | | |
| | sicℓ | | | | |
| Eufaula | lfs | | | | |
| | lfs | | | | |
| | lfs | | | | |
| | ls | | | | |
| Faceville | vfsl | | | | |
| | fsℓ | | | | |
| | lfs | | | | |
| | sl | | | | |
| | ls | | | | |
| | sl | | | | |
| Foley | | | | | |
| Fullerton | | | | | |
| Grenada | | | | | |

| Series | Texture | K | si + vfs | s >vfs | OM | structure | Perm |
|---|---|---|---|---|---|---|---|
| Grenada | si | 68 | 91 | 1 | 1.9 | 2 | 5 |
| | sil | 58 | 84 | 1 | 1.8 | 2 | 5 |
| | si | 65 | 89 | 1 | 1.9 | 2 | 5 |
| | si | 50 | 87 | 1 | 4.0 | 2 | 5 |
| | si | 69 | 91 | 1 | 1.7 | 2 | 5 |
| | si | 68 | 91 | 1 | 1.9 | 2 | 5 |
| | sil | 63 | 83 | 4 | 0.9 | 2 | 5 |
| | sil | 58 | 81 | 2 | 1.0 | 2 | 5 |
| | sil | 58 | 80 | 9 | 1.8 | 2 | 5 |
| | Sil | 57 | 84 | 1 | 1.9 | 2 | 5 |
| | Sil | 62 | 85 | 2 | 1.5 | 2 | 5 |
| | sil | 56 | 81 | 2 | 1.5 | 2 | 5 |
| | si | 68 | 90 | 1 | 1.7 | 2 | 5 |
| | si | 70 | 91 | 1 | 1.5 | 2 | 5 |
| | Sil | 52 | 85 | 1 | 3.2 | 2 | 5 |
| Henry | Sil | 45 | 80 | 6 | 4.0 | 2 | 5 |
| | si | 51 | 87 | 2 | 4.0 | 2 | 5 |
| | sil/si | 54 | 86 | 2 | 3.2 | 2 | 5 |
| | si/sil | 59 | 83 | 5 | 1.8 | 2 | 5 |
| | Sil | 45 | 82 | 2 | 4.0 | 2 | 5 |
| | si | 67 | 87 | 3 | 1.2 | 2 | 5 |
| | si | 68 | 86 | 6 | 1.2 | 2 | 5 |
| | si | 68 | 87 | 6 | 1.4 | 2 | 5 |
| Hidalgo | fsl | 23 | 34 | 52 | 1.5 | 3 | 3 |
| | fsl | 23 | 34 | 51 | 1.2 | 3 | 3 |
| | scℓ | 27 | 41 | 34 | 1.7 | 4 | 3 |
| | scℓ | 27 | 39 | 39 | 1.5 | 4 | 3 |
| Houston | c | 17 | 36 | 2 | 3.8 | 3 | 6 |
| | sic | 28 | 51 | 3 | 1.9 | 3 | 6 |
| | sic | 26 | 50 | 3 | 3.1 | 3 | 6 |
| Houston Black | c | 23 | 38 | 6 | 2.6 | 4 | 6 |
| | c | 24 | 43 | 3 | 4.0 | 4 | 6 |
| | c | 23 | 41 | 3 | 4.0 | 4 | 6 |
| | sic | 26 | 47 | 3 | 4.0 | 4 | 6 |
| | c | 23 | 41 | 3 | 4.0 | 4 | 6 |
| | c | 23 | 39 | 4 | 3.1 | 4 | 6 |
| | c | 26 | 42 | 2 | 1.4 | 4 | 6 |
| Iredell | sl | 19 | 28 | 43 | 1.0 | 3 | 4 |
| | loam | 36 | 54 | 33 | 1.7 | 2 | 4 |
| | sl | 33 | 44 | 43 | 0.2 | 2 | 4 |
| Kirkland | sil | 46 | 67 | 7 | 1.7 | 3 | 6 |
| | sil | 51 | 76 | 2 | 2.4 | 3 | 6 |
| Linker | fsl | 37 | 46 | 49 | 0.7 | 3 | 3 |
| | fsl | 40 | 52 | 40 | 0.9 | 3 | 3 |
| | loam | 19 | 35 | 43 | 3.1 | 3 | 3 |
| | loam | 20 | 35 | 40 | 1.9 | 3 | 3 |
| Lufkin | vfsl | 40 | 62 | 4 | 1.2 | 3 | 6 |
| | loam | 58 | 67 | 23 | 1.0 | 3 | 6 |
| Mantachie | fsl | 33 | 49 | 40 | 1.8 | 3 | 3 |

| Series | Texture | K | si + vfs | s >vfs | OM | structure | Perm |
|---|---|---|---|---|---|---|---|
| Mason | loam | .53 | 73 | 17 | 1.9 | 3 | 4 |
| Maury | sil | 41 | 72 | 5 | 2.4 | 3 | 3 |
| | Sil | 41 | 69 | 9 | 1.0 | 2 | 3 |
| | sil | 39 | 66 | 17 | 1.8 | 2 | 3 |
| | sil | 45 | 73 | 10 | 1.5 | 2 | 3 |
| | Sil | 42 | 74 | 5 | 1.8 | 2 | 3 |
| | Sil | 42 | 73 | 7 | 2.7 | 3 | 3 |
| Memphis | Sil | 48 | 78 | 1 | 1.0 | 2 | 3 |
| | sil | 59 | 86 | 1 | 1.2 | 2 | 3 |
| | Sil | 58 | 85 | 1 | 1.2 | 2 | 3 |
| | Sil | 63 | 88 | 2 | 1.3 | 2 | 3 |
| | si/sil | 63 | 87 | 2 | 1.0 | 2 | 3 |
| Miles | fsl | 25 | 40 | 45 | 0.8 | 2 | 3 |
| | fsl | 21 | 37 | 41 | 0.6 | 2 | 3 |
| | fsl | 22 | 42 | 35 | 1.4 | 2 | 3 |
| | ℓ | 36 | 63 | 15 | 1.5 | 2 | 3 |
| | fsl | 37 | 59 | 26 | 1.2 | 2 | 3 |
| | scℓ | 25 | 37 | 54 | 0.7 | 2 | 3 |
| | fsl | 15 | 27 | 56 | 0.9 | 2 | 3 |
| Nobscot | fs | 04 | 16 | 82 | 1.5 | 1 | 2 |
| | fs | 06 | | | | | |
| Nolin | Sil | | | | | | |
| | sil | | | | | | |
| Norfolk | ls | | | | | | |
| | fsl | | | | | | |
| | lfs | | | | | | |
| | lfs | | | | | | |
| | fsl | | | | | | |
| | lfs | | | | | | |
| Norfolk | lfs | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| Orangeburg | sl | | | | | | |
| | fsl | | | | | | |
| | ls | | | | | | |
| | fsl | | | | | | |
| | fsl | | | | | | |
| Pelham | fs | | | | | | |
| | s | | | | | | |
| Placid | fs | | | | | | |
| | fs | | | | | | |
| | s | | | | | | |
| | fs | | | | | | |
| | s | | | | | | |
| Pomello | fs | | | | | | |
| | fs | | | | | | |
| Pullman | cℓ | | | | | | |
| | cℓ | | | | | | |

| Series | Texture | K | si + vfs | s >vfs | OM | structure | Perm |
|---|---|---|---|---|---|---|---|
| Pullman | cℓ | 33 | 50 | 20 | 1.4 | 3 | 5 |
| | sicℓ | 39 | 65 | 2 | 1.7 | 3 | 5 |
| | sicℓ | 37 | 64 | 1 | 1.7 | 3 | 5 |
| Reagan | loam | 46 | 68 | 18 | 1.7 | 3 | 3 |
| | loam | 40 | 64 | 17 | 1.8 | 3 | 3 |
| Red Bay | lfs | 15 | 24 | 67 | 1.2 | 2 | 3 |
| | Sl | 12 | 21 | 65 | 0.7 | 2 | 3 |
| | SCl | 17 | 28 | 48 | 1.5 | 3 | 3 |
| | fsl | 19 | 28 | 55 | 1.0 | 3 | 3 |
| | sl | 14 | 21 | 62 | 1.9 | 3 | 3 |
| | sl | 17 | 25 | 61 | 1.8 | 3 | 3 |
| | sl | 13 | 27 | 58 | 3.1 | 2 | 3 |
| | fsl | 15 | 21 | 62 | 1.0 | 3 | 3 |
| | Sl | 14 | 24 | 57 | 2.6 | 3 | 3 |
| | Sl | 13 | 23 | 63 | 0.9 | 2 | 3 |
| Ruston | fsl | 27 | 48 | 44 | 4.0 | 3 | 3 |
| | ℓ | 40 | 57 | 36 | 2.1 | 3 | 3 |
| | fsl | 23 | 33 | 60 | 2.0 | 3 | 3 |
| | fsl | 45 | 62 | 31 | 1.8 | 3 | 3 |
| Saffell | Sl (gv) | 30 | 50 | 45 | 3.8 | 3 | 3 |
| Savannah | fsl | 55 | 64 | 33 | 1.5 | 3 | 4 |
| | Sil | 53 | 67 | 22 | 0.8 | 3 | 4 |
| | Sil | 60 | 74 | 21 | 1.4 | 3 | 4 |
| Sharkey | sic | 36 | 59 | 1 | 2.6 | 4 | 6 |
| | sic | 28 | 49 | 2 | 3.2 | 4 | 6 |
| | c | 22 | 37 | 2 | 2.5 | 4 | 6 |
| | c | 16 | 20 | 1 | 3.5 | 4 | 6 |
| | sic | 29 | 49 | 1 | 2.0 | 4 | 6 |
| Shelocta | loam | 23 | 54 | 19 | 3.4 | 2 | 3 |
| | Sil | 52 | 77 | 7 | 1.5 | 3 | 3 |
| | sil | 32 | 66 | 8 | 3.4 | 3 | 3 |
| | sil | 45 | 72 | 10 | 2.0 | 3 | 3 |
| St. Paul | Sil | 48 | 76 | 4 | 2.3 | 3 | 4 |
| | Sil | 56 | 81 | 6 | 1.5 | 2 | 4 |
| | sil | 59 | 82 | 2 | 1.4 | 3 | 4 |
| Sumter | sic | 23 | 47 | 11 | 3.6 | 3 | 5 |
| | Cl | 27 | 52 | 11 | 3.2 | 3 | 5 |
| | sic | 23 | 48 | 12 | 4.1 | 3 | 5 |
| | sic | 24 | 51 | 9 | 4.0 | 3 | 5 |
| Susquehanna | Sil | 43 | 70 | 11 | 4.0 | 3 | 6 |
| | lvfs | 43 | 53 | 43 | 1.9 | 2 | 6 |
| | lfs | 21 | 21 | 75 | 1.2 | 2 | 6 |
| | fsl | 41 | 64 | 29 | 4.0 | 2 | 6 |
| Tarrant | c (cobbly) | 16 | 38 | 1 | 4.0 | 4 | 4 |
| | sic | 21 | 46 | 7 | 4.0 | 4 | 4 |
| | sic | 20 | 46 | 2 | 4.0 | 4 | 4 |
| Tif ton | ls | 11 | 18 | 78 | 1.0 | 2 | 3 |
| | lfs | 15 | 23 | 70 | 0.9 | 2 | 3 |
| | lfs (gv) | 20 | 31 | 64 | 1.4 | 2 | 3 |
| | ls | 09 | 15 | 78 | 1.2 | 2 | 3 |
| | fsl | 28 | 44 | 49 | 1.9 | 2 | 3 |
| | loam | 25 | 54 | 31 | 4.0 | 2 | 3 |

| Series | Texture | K | si + vfs | s > vfs | OM | structure | Perm |
|---|---|---|---|---|---|---|---|
| Tillman | Cl | .24 | 39 | 30 | 1.0 | 2 | 5 |
| | sicl | 43 | 69 | 4 | 1.9 | 3 | 5 |
| | Sil | 42 | 75 | 5 | 4.0 | 3 | 5 |
| | sicl | 35 | 61 | 4 | 2.0 | 3 | 5 |
| Tivoli | fs | 01 | 14 | 84 | 0.3 | 1 | 1 |
| | s | (-) 01 | 10 | 87 | 0.5 | 1 | 1 |
| | fs | (-) 01 | 12 | 86 | 0.5 | 1 | 1 |
| Vaiden | sic | 21 | 49 | 4 | 4.0 | 3 | 5 |
| | sic | 21 | 47 | 6 | 4.0 | 3 | 5 |
| White Store | ℓ | 48 | 65 | 24 | 2.0 | 2 | 6 |
| | Sil | 47 | 69 | 19 | 2.9 | 2 | 6 |
| Woodward | vfsl | 55 | 73 | 16 | 1.0 | 3 | 3 |
| | ℓ | 46 | 77 | 7 | 2.0 | 2 | 3 |
| | vfsl | 51 | 77 | 10 | 1.5 | 2 | 3 |
| | fsl | 40 | 60 | 30 | 1.5 | 2 | 3 |

| Series | Textural phase | Calculated K's | Reported K on scs-5 |
|---|---|---|---|
| Allen | fsl | .24,.18 | |
| | l/sil | .42 | |
| Amagon | sil | .54,.68,.70,.54,.55 | |
| | fsl | .40,.36 | |
| Amarillo | fsl | .16,.28,.35,.26,.33,.35,.21,.22,.18,.13,.19 | |
| | lfs | .16,.18,.27,.15 | |
| | scl | .33,.29,.32,.28,.25,.32 | |
| Astatula | s | (-) .01 | |
| Austin | sic | .23,.25,.21,.27,.26,.31 | |
| | c | .14 | |
| Axtell | fsl | | |
| | vfsl | | |
| | sil | | — |
| Bladen | fsl | | |
| | l | | |
| | sil | | |
| | vfsl | | |
| Bowie | fsl | | |
| | fs | | |
| | Sil | | — |
| | vfsl | | — |
| Calhoun | si | | — |
| | Sil | | |
| | sicl | | |
| Cecil | Sl | | |
| | fsl | | |
| | Cl | | |
| | l | | |
| | ls | | |
| Commerce | Sil | | .43 |
| | fsl | | |
| Crider | sil | | |
| Crowley | Sil | | |
| | si | | |
| Dalhart | fsl | | |
| | lfs | | |
| Darco | lfs | | |
| Decatur | Sil | | |
| | l | | |
| | sid | | |
| | cl | | |
| Dennis | Sil | | |
| Dothan | ls | | |
| | fsl | | |
| | Sl | | |
| Duval | fsl | | |
| | lfs | | |
| | vfsl | | |

| Series | Textural phase | Calculated K's | Reported K on scs-5 |
|---|---|---|---|
| Eden | sic | .24,.25 | .43 |
| Enders | fsl | .30,.36 | .37 |
| | 1 | .39,.53 | .37 |
| | sicl | .46 | |
| Eufaula | lfs | .13,.11,.12 | $\overline{.17}$ |
| | ls | .01 | |
| Faceville | ls | .34 | $\overline{.17}$ |
| | lfs | .18 | .17 |
| | sl | .20,.25,.32 | .28 |
| | fsl | .15,.27 | .28 |
| Foley | sil | .39,.58,.68,.70 | .43 |
| | sicl | .32 | |
| Fullerton | Sil | .34,.26,.49,.42,.47,.37 | $\overline{.28}$ |
| | 1 | .26 | .28 |
| Grenada | sil | .62,.56,.52,.49,.75,.57,.59,.58,.63,.58,.58,.57 | .49 |
| | Si | .61,.68,.65,.50,.69,.68,.68,.70 | |
| Henry | Sil | .45,.54,.45 | $\overline{.49}$ |
| | Si | .51,.59,.67,.68,.68 | |
| Hidalgo | fsl | .23,.23 | $\overline{.24}$ |
| | SC1 | .27,.27 | .32 |
| Houston | c | .17 | .37 |
| | sic | .28,.26 | |
| Houston Black | c | .23,.24,.23,.23,.23,.26 | $\overline{.32}$ |
| | sic | .26 | .32 |
| Iredell | Sl | .19,.33 | .28 |
| | loam | .36 | .32 |
| Kirkland | Sil | .46,.51 | .49 |
| Linker | fsl | .37,.40 | .28 |
| | loam | .19,.20 | .28 |
| Lufkin | ufsl | .40 | .43 |
| | loam | .58 | .43 |
| Mantachie | fsl | .33 | .28 |
| Mason | loam | .53 | |
| Maury | Sil | .41,.41,.39,.45,.42,.42 | $\overline{.32}$ |
| Memphis | Sil | .48,.59,.58,.63 | .49 |
| | si | .63 | |
| Miles | fsl | .25,.21,.22,.37,.15 | $\overline{.24}$ |
| | loam | .36 | |
| | SC1 | .25 | — |
| Nobscot | fs | .04,.06 | $\overline{.17}$ |
| Nolin | Sil | .53,.50 | .43 |
| Norfolk | ls | .26 | .17 |
| | fsl | .39,.28,.18,.22,.22,.27 | .20 |
| | Ifs | .17,.19,.14,.15 | .17 |
| Orangeburg | sl | .22 | .20 |
| | fsl | .16,.28,.17 | .20 |
| | ls | .06 | .10 |
| Pelham | fs | .11 | .10 |
| | S | .14 | .10 |

| Series | Textural phase | Calculated K's | Reported K on scs-5 |
|---|---|---|---|
| Placid | fs | .05,.06,.01 | .10 |
| | s | .01,.01 | .10 |
| Pomello | fs | .04,.04 | .10 |
| Pullman | Cl | .40,.40,.33 | .37 |
| | sicl | .39,.37 | .37 |
| Reagan | loam | .46,.40 | .32 |
| Red Bay | Ifs | .15 | .10 |
| | Sl | .12,.14,.17,.13,.14,.13 | .20 |
| | scl | .17 | .20 |
| | fsl | .19,.15 | .20 |
| Ruston | fsl | .27,.23,.45 | .28 |
| | loam | .40 | |
| Saffell | sl (gv) | .30 | .20 |
| Savannah | fsl | .55 | .24 |
| | sil | .53,.60 | .37 |
| Sharkey | sic | .36,.28,.29 | .32 |
| | c | .22,.16 | .32 |
| Shelocta | loam | .23 | .32 |
| | sil | .52,.32,.45 | .32 |
| St. Paul | Sil | .48,.56,.59 | .37 |
| Sumter | sic | .23,.23,.24 | .37 |
| | Cl | .27 | |
| Susquehanna | Sil | .43 | .37 |
| | lufs | .43 | |
| | lfs | .21 | — |
| | fsl | .41 | .28 |
| Tat-rant | c | .16 | .20 |
| | sic | .21,.20 | .20 |
| Tifton | ls | .11,.09 | .10 |
| | Ifs | .15,.20 | |
| | fsl | .28 | .17 |
| | loam | .25 | |
| Tillman | Cl | .24 | .32 |
| | sicl | .43,.35 | .32 |
| | sil | .42 | |
| Tivoli | fs | .01,.01 | .17 |
| | s | .01 | |
| Vaiden | sic | .21,.21 | .37 |
| White store | loam | .48 | .43 |
| | Sil | .47 | .43 |
| Woodward | ufsl | .55,.51 | .37 |
| | loam | .46 | .37 |
| | fsl | .40 | |

## Appendix II

Proposal by: Robert F. Berry, area conservationist, SCS, Alabama

Current and past methods of reporting SCS progress has been tied to either a measurable quantity of production such as linear feet of terraces constructed, acres of land planned or to an estimated degree of protection provided such as land adequately protected. Today we have begun to look at tons of soil saved as if it were a magical figure. In reality it is only a measure of soil resource base saved without a value of that measure.

Another factor that complicates the meaning of soil loss is in the assigned "T" values to various soil series. The "T" value should be a measure of the fragility of a soil series as it related to permanent production capacity damage under a standard or set of standards of crop production. The current "T" values have other considerations such as water quality included. Any factor other than resource base damage should be addressed in a different manner.

The fallacy of using tons of soil saved and current "T" values is shown in the following illustration:

A soil such as Orangeburg may have a soil loss of 20 tons per acre per year before conservation practices are installed. After installation of practices the loss is reduced to 10 tons per acre per year or 10 tons of soil saved per acre per year. The "T" value of Orangeburg is five tons per acre per year. To look at a contrast let's compare the Orangeburg to a Oothan soil with a "T" value of four tons per acre per year. let's assume that before the installation of conservation practices the soil loss is 12 tons per acre per year. After practices are installed the loss is reduced to eight tons per acre per year or a savings of four tons per acre per year.

Now let's ask ourselves which resource base have we benefited the most. On the surface it appears that the Orangeburg would benefit most due to the savings of ten tons per acre per year as compared to the four tons for the Dothan. In reality Orangeburg has less production damage under current management techniques with a loss of one inch of soil than does Dothan. The damage to a soil series due to erosion will vary at the same tonnage loss. To put it another way, Dothan soils will be out of production with a soil loss of 12 to 24 inches; whereas, Orangeburg will be affected very little with current management techniques. It should be pointed out here that the level of management imposed on a soil resource could vary this response in some soil series while having little effect on others.

The current movement toward evaluating soil conservation activities against tons of soil saved as cost per ton will tend to debase much of our best crop land over a long time period. It will tend to encourage SCS activity on soils (class IV and VI with the greatest loss not necessarily soils (class II and III) best suited to long term production.

I propose that the two factors outlined below be included in the I&M and regular reporting system which recognizes not only soil resource base loss and savings but the degree of damage that the soil resource has sustained tcdate.

1/ Resource Base Values

Values are assigned each soil series or major crop producing soil series based upon evaluations of potential production capacity of the current state of the soil resource. The ratings could be set up as follows:

| Resource Base Value Explanation | | Resource Base Values |
|---|---|---|
| 100% | Virgin soil top production potential | 10 |
| 90% | 10% loss of production potential | 9 |
| 80% | 20% " " " " | 8 |
| 70% | 30% " " " " | 7 |
| 60% | 40% " " " " | 6 |
| 50% | 50% " " " " | 5 |
| 40% | 60% " " " " | 4 |
| 30% | 70% " " " " | 3 |
| 20% | 80% " " " " | 2 |
| 10% | 90% " " " " | 1 |
| 0 | 100% " " " " | 0 |

The factors affecting resource base values could include two or more or any combination of the following depending upon soil series; topsoil depth, gullying, rate of soil loss, bulk density or root zone, fertility of root zone, mineralogy of soil, morphology of soil, and current management scheme.

The resource base value is a measure that could best be applied to the Inventory and Monitoring Program where resource potential could be measured over a period time for trends.

2/ Critical "T" Values

"T" values would have to be changed to reflect the level of soil loss above which permanent damage to the productive capacity of the soil series occurs at a given level of management. These could be called critical "T" values.

By changing the "T" values the proposed system will allow soil resource damage to be measured and predictable for a soil series.

I realize that some additional research is needed and some questions ansrrered before this proposal could be implemented, but we have enough soil scientists and soil conservationists in the field to put together some statistically reliable data in a short period of time.

An example of what this system could mean is as follows:

| Sample Year | Soil | Class | Resource Value | Critical "T" | Current Soil Loss T/A/Yr |
|---|---|---|---|---|---|
| 1981 | Orangeburg fsl | II | 7 | 10 | 20 |
| 2001 | Orangeburg fsl | II | 6 | 10 | 20 |

Here we see approximately two-tenths of a foot of Orangeburg soil lost in 20 years with a 14 percent yield potential loss damage under current management over a 20-year period. Soil loss is a realistic 2T.

| | | | | | |
|---|---|---|---|---|---|
| 1981 | Dothan fsl | II | 7 | 4 | 20 |
| 1991 | Dothan fsl | II | 6 | 4 | 20 |
| 2001 | Dothan fsl | II | 4 | 4 | 20 |

Here we see approximately one-tenth of a foot of Dothan soil lost in 10 years. There is a 15 percent yield potential loss in 10 years and a 43 percent yield potential loss under current management over a 20-year period. uamage is accelerating as topsoil decreased at a constant rate. Soil loss is a realistic 5T. However, a soil such as Dothan may need a declining "T" value as the resource value declines because it becomes more fragile as erosion occurs.

In this example the Orangeburg soil may have lost all of its topsoil and more by the time the resource value was estimated the first time. The Dothan soil probably would not have lost more than one-third of the topsoil at the time of the first rating. We could predict that the Dothan soil would be near zero production in less than 40 years.

By taking the number of acres of a given soil series, the average resource base value of the soil series, the critical "T" value and current average rate of soil loss, a prediction could be made as to when production problems such as cost versus potential yields would move much of the acreage out of production at a set standard or management once the criteria for resource ratings were established. Two resource base value ratings over time would be required for most soils before predictions would be meaningful.

The variations between major agricultural soils are so great as it relates to erosion versus production that the factors must be accounted for before tons of soil saved can have any real meaning. We are using false economic evaluations when we consider only tons of soil saved without regard to varying rates of damage to the production capacity of individual soil series.

Problems

3. Many conservationists do not have a basic understanding of the LISLE. This equation does a good job in predicting annual loss from simple slopes. Most management units do not have simple slopes or are composed of only one soil. Conservationists tend to want one value from a field which can have a wide range of possible values that can be generated by the USLE.

Committee VIII - Soil Survey and Woodland Interpretations

Chairperson: Peter E. Avers

Vice-Chairperson: Sharon G. Haines

| Members: | | | |
|---|---|---|---|
| | N. B. Comerford | Dan Weary | Darwin Newton |
| | Don Eagleston | W. I. Smith | J. R. Vann |
| | C. L. Fultz | Bill Waite | W. Joe McCoy |
| | W. K. Goddard | K. G. Watterson | Dan Manning |
| | Glenn Harris | R. L. Wilkes | R. F. Fisher |
| | G. W. Hurt | Terry Sarigumba | |

**Charges:**

Charge 1. Develop instructions for making second generation interpretations to meet individual land owner needs for woodland management.

Charge 2. Suggest ways to develop more reliable productivity ratings.

Charge 3. Outline techniques for training foresters in soil taxonomy and forest soil management.

Committee Report

Charge 1. Develop instructions for making second generation interpretations to meet individual landowner needs for woodland management.

Second generation interpretations are specific, local user oriented soil ratings that are generally not included in the published Survey. These interpretations can be quite variable depending on land ownership goals and are thought to be either too numerous for the published survey or they lack generally accepted criteria standards. Also, new technology, changing land uses, and changing management objectives and concepts dictate information needs that require reinterpretation uf existing data bases. To be responsive to management needs, soil scientists must be able to develop second generation interpretaitons where appropriate. Basically, this extension demands close scrutiny of the original soils data base, analyses of applicable research and development of criteria for predicting precision and reliability of ratings. Instructions for making Second Generation Interpretations:

1. Determine Suitability of Existing Surveys

Modern Order 2 soil surveys made with due consideration to forest management are suitable data bases for second generation forest soil interpretations. Some standard surveys (particularly older ones) and reconnaissance surveys contain rather broadly defined map units for forested land

and often lack the detail needed for reliable interpretations. An example cited by one respondent of a good survey of forested land is the survey on the Talladega National Forest, Oakmulgee Division. Other good examples exist in the South.

2. Utilize Research and Other Resource Data

Assemble and analyze available sources of data pertinent to the kinds of interpretations to be made. Other resource inventories can provide valuable information. Localized research data will be of the grestest value in developing reliable interpretations. The original field sheets for a pbulished survey may be a helpful tool. Knowledge available at universities should be accumulated and utilized. Availability of data from private industry should be determined. Research data correlated to soil type is often very useful. Literature search services, such as SOUTH FORNET in Athens, Georgia, can be valuable aids in assembling needed information.

3. Developing the Interpretations

a. A suggested method of developing interpretations is to develop ratings for various interpretations on a survey by survey basis and include and discuss in a handbook or survey report. Soils experts from industry, states and federal agencies should provide data necessary to assign ratings for each interpretation. A major advantage of this approach is that interpretations can be tailored to local survey area conditions.

b. A step by step approach is offered: (1) analyze the literature for appropriate studies as suggested in #2, (2) list those soil factors most commonly affecting tree growth or other interpretations, (3) field check the interaction of these soil properties with the forest management prac tices of concern in a survey area, and (4) mold these into interpretations that include realistic potentials and limitations of use. Instead of listing the interpretation, possibly listing it with its probability of success and range of response is a better way of handling it. The user should not be lured into a false sense of knowledge. This stepwise approach can be used for all interpretations. We know that reasonable recommendations for fertilization are possible, when soil maps, soil chemical analysis and on site investigation are combined. Regardless of the approach used, foresters should clearly understand how the interpretations were developed.

4. Publication

Several methods of publication are available including presenting second generation type interpretations in new surveys and issuing them as supplements to older surveys. Another option is to prepare a handbook on harvesting (harvesting hazards, soil compaction, landslides, soil slump, skid trail location, etc.) and on silvicultural activities (fertilization, regeneration, productivity, management units, herbicide use, windthrow hazard after thinning, etc.). Alabama (and perhapd other states) is developing a handbook of first and second generation management practices. A loose leaf notebook that can be updated periodically would also be useful.

Another place for publication is in the "Service Forester's Handbook." State and Private Forestry Soils Specialists could assist in preparation as part of their technology transfer program.

As a tie-in with charge #3, notebooks or handbooks could be initiated with general taxonomic terminology of interest to foresters (an elaboration of tables g-11, pages 88-90 of Soil Taxonomy) followed by general descriptive interpretations at the Great Group level.

Example: Quartzipsamments - regions with summer drought should not be clearcut unless there is a-means of protecting the following seedlings from exposure to wind and sun.

Example: Glossaqualfs - should be examined for soluble salts in the subsoil before a harvest decision is made. If salts are present, a partial cutting system that will continue to provide transpirational water cycling should be used to prevent an vaporation system from bringing salts to the surface thereby preventing regeneration.

Key points that need to be considered when making current soil surveys.

1. More time needs to be spent on map unit design and consistency of mapping than presently alloted to these activities.

2. Statements on reliability and precision of maps and interpretations need to be included in the Survey. Variability within map units (external and internal properties) must be decreased to develop reliable interpretations.

3. When evaluating internal soil characteristics for map unit design, kept in mind that trees have the potential to utilize a large soil volume with deep rooting systems.

4. Surveys on forested land need the same level of intensity as surveys on other lands. The land user may choose to lump mapping units by characteristics important for a particular use but this does not remove the need for a common level of intensity.

5. The distinction between mapping units and taxonomic units must be made clear to the forester. Foresters and Soil Scientists must be encouraged to work together in designing the mapping units for surveys in forested areas.

Charge 2. Suggest ways to develop more reliable productivity ratings.

1. Almost unanimous support exists to provide productivity ratings that are more site specific than those currently in use. Productivity ratings that are applied Southwide are not satisfactory. Differences within series or survey areas in such characteristics as elevation, latitude, and aspect are not currently given adequate consideration. Data utilized in developing productivity ratings for a survey area must be collected within that area. If this is impossible, only data from plots located on very similar soils and sites outside the survey area should be used.

2. No single productivity rating is applicable to a soil map unit; average site index values have extremely limited utility. Ranges of productivity within a map unit should be documented so that the survey user has a better feel fur the variation in productive potential within the map unit. The range of soil characteristics (particularly those thought to be very closely tied to productivity) within map units needs more detailed documentation. For forest management, the general consensus is that profile examinations should be carried to further depths (especially on deep sands), perhaps as much as 3 m.

3. Results of intensive forest management on ultimate productivity are not given sufficient consideration at present. Data bases are predominantly from old field sites. Since productivity of old fields is not duplicated on site prepared lands, such productivity estimates have little utility. We need good site index information for site prepared, intensively managed stands. Such information would greatly enhance the utility of published surveys to private industry.

4. Permanent productivity plots offer the best opportunity for accumulation of data with maximum utility. Unfortunately, this

is a very expensive alternative. A series of strategically located temporary plots for local situations can be extremely valuable, however. Past land use and stand conditions at the time of plot establishment should be carefully documented. By developing more localized data bases, local site index curves and yield tables (if stem analysis data are collected) can be provided. In every case, actual measurements of site index are preferred to estimates.

5. Efforts should continue in soilsite productivity research even though advances seem particularly slow in materializing. It is very important that foresters and soil scientists communicate more effectively. Foresters should be alert to situations where dramatic productivity differences occur on soils and sites that seem quite similar. Subsequent examination by a soil scientist may help identify reasons for the differences.

   Sharing of research data should be encouraged. Forest industry is not as receptive to this as government agencies are. More and more companies are considering their data bases as proprietary information. A mutually agreeable solution that would allow data to be shared should be pursued.

   As an interim measure, the approach listed below appears reasonable. A compilation of existing plot data within counties with published surveys can serve as a starting point. Ranges of productivity within map units can be documented to some degree. While this approach will not provide the final answer, it will give the survey user a much more usable piece of information than he currently has.

   1. Survey cooperating agencies or industries to determine the amount and form of the data, and the manner in which it is geo-referenced.

   2. Develop a reporting form to standardize data and rate data reliability.

   3. Collect and collate data.

   4. Cross-reference plot locations to published soil surveys or some type of uniform landscape description.

   5. Send out preliminary data for review.

   6. Compile final statewide forest productivity ratings by physiographic regions.

   7. Distribute to cooperators for final review.

   8. Revise and publish.

Charge 3. Outline techniques for training foresters in soil taxonomy and forest soil management.

1. The consensus is that the more a forester knows about soils and their response to management, the more apt he is to make good management decisions. When foresters recognize the value of soils data, they are likely to actively seek out sources of information in addition to published soil surveys (e.g., soil related research reported in scientific journals).

   The first challenge is to demonstrate to the forester the value of soils information and how he can use it to its best advantage. One respondent suggested using extreme soil-site conditions (very productive vs. very unproductive). A forester can more readily see the impact of specific soil properties in such situations. Soil-site characteristics can be used to demonstrate how money can be made on the best sites and to identify sites of such low productivity that they should be managed extensively, if at all.

   Many foresters are not comfortable with Soil Taxonomy largely because they are unfamiliar with the terminology. It will be difficult to keep training current with modifications to the system. The key will be how well grounded foresters are in the basic principles of taxonomy rather than how well they remain current on every minor modification made.

2. A key to forester use and appreciation of soil taxonomy is compilation of the basic information in a user-oriented format. The use of a dichotomous key might be helpful. A revision of FSH 2509.15, Handbook on Soils, should be of value also. Good forest soils texts tailored to specific regions of the country are needed. Room also exists for a taxonomy text written from the perspective of forest management.

3. Soils courses (plural not singular) should be required in all forestry curricula, preferably three-basic soils, forest soils, and soil taxonomy with a forestry slant. It is recognized that three courses are ideal but may not be practical in view of the forestry curriculum pressures. The key is to get an emphasis on taxonomic interpretation into the introductory (basic) soils course. In addition to providing foresters with hasic soils information, it would be wise to require soil scientists to be exposed to a forest soils course. This would give them a better appreciation of forest soils problems and needs. In addition to classroom instruction, field trips to permit on-the-ground demonstrations of the utility of taxonomic and other soils information is needed. Student exposure to practicing foresters who are using soils information on a daily basis should be beneficial.

4. A sound academic background in soils is needed but on-the-job training and continuing education programs will be required. Foresters can learn by participating in progress field reviews. The workshop format with on-the-ground demonstrations and discussion can be very effective. The SCS and cooperating agencies in Alabama held a Forest Soils Workshop in 1980 which was attended by 180 private and industrial foresters. Continuing education short courses at local colleges and universities are needed to help foresters maintain competency and remain current on advances and refinements in soils interpretations. These short courses should have SAF Continuing Education recognition.

## Conclusion

Interest continues to increase in using soils information in day to day forest management activities and in long range forest land management planning. There are many opportunities to improve forest soil interpretations and the techniques of transferring and communicating soils information to forest land managers.

## Recommendation

It is recommended that the committee be continued. The charge for the next conference should center on the application of soil surveys to forest management planning and soil productivity monitoring.

NATIONAL COOPERATIVE SOIL SURVEY

Southern Regional Conference Proceedings

Oklahoma City, Oklahoma
March 16-20, 1980

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# PROCEEDINGS
# OF SOUTHERN REGIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY

**Oklahoma City, Oklahoma**
**March 16-20, 1980**

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

United States Department of Agriculture

Soil Conservation Service

State Office
Stillwater, OK
74074

Subject: 1980 Southern Regional Technical Work Planning Conference of the National Cooperative Soil Survey

Date: October 31, 1980

To: Recipients of Proceedings

The Conference convened at 9:00 a.m., Monday, March 17, 1980 at the Lincoln Plaza Inn, Oklahoma City, Oklahoma.

The program committee extends its special thanks and appreciation to guest speakers who addressed the general sessions.

The committee chairmen and members are commended for their efforts to address the issues their presentations during the conference and the resulting reports which are included in the proceedings.

Florida was chosen as the host state for 1982. Dr. V. W. Carlisle, University of Florida, will serve as chairman for the conference and Mr. Robert Johnson, State Soil Scientist, Soil Conservation Service, will serve as vice-chairman,

The conference adjourned at 11:45 a.m., March 20, 1980.

Bobby T. Birdwell
Bobby T. Birdwell
Chairman

Fenton Gray
Fenton Gray
Vice-Chairman

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# INTRODUCTION

The purpose of the Southern Regional Technical Work Planning Conference is to provide a forum for Southern States representatives of the National Cooperative Soil Survey and invited participants for discussing technical and scientific developments pertaining to soil surveys. Through committee actions current issues are addressed, new ideas explored, new procedures are proposed, new techniques are tested, and conventional methods and materials are evaluated. Participants bring rich experiences relating to soil surveys which are exchanged during the conference. Conference recommendations and proposals are forwarded to the National Technical Work Planning Conference and may well become the basis for new or revised National Soil Survey policy and/or procedures.

# AGENDA

## 1980 SOUTHERN REGIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE NATIONAL COOPERATIVE SOIL SURVEY

Lincoln Plaza Inn
Oklahoma City, Oklahoma
March 16 - 20, 1980

Sunday, March 16

PM 4:00-7:00

Monday, March 17

AM 8:00

9:00

9:15

9:30

10:10

10:50

11:30

PM 1:00

1:30

| | | |
|---|---|---|
| Tuesday, March 18 | Committee Work | Chairman |
| AM 8:00 - 12:00 | No. 1 - Use and Interpretation of Soil Survey Characterization Data | Moye Rutledge |
| | No. 2 - Soil Variability and Quality Soil Surveys | Charles Thompson |
| | No. 3 - Training Soil Scientists (Academic and Field) | H. H. Bailey |
| | No. 4 - Soil Surveys and Land Assessments | B. L. Harris |
| 12:00 | Lunch | |
| PM 1:30 - 5:30 | No. 5 - Updating Published Soil Surveys | W. M. Koos |
| | No. 7 - Soil Survey Educational and Information Program | H. J. Kleiss |
| | No. 8 - Coastal Wetlands - Their Classification and Correlation | Arville Touchet |
| | No. 9 - Soil Surveys for Woodlands and Their Interpretations | Pete Avers |
| | Adjourn | |
| Evening | Prepare Committee Reports | |
| Wednesday, March 19 | | |
| AM 8:00 | Remote Sensing Symposium | Carter Steers |
| | "Application of Ground Penetrating Radar to Soil Survey" - Bob Johnson | |
| | "Mapping of Tidal Marsh Soils by False Color Imagery in Mississippi" W. I. Smith | |
| | "Use of IR Mississippi Bottomland and Gulf Coast" - Arville Touchet | |
| | "Use of Landsat Based.Information System for Soil Survey and Related Purposes by Local, State and Federal Agencies" - W. Frank Miller | |
| | "Remote Sensing Used in Soil/Forest Programs by the U.S. Forest Service in the South" - Pete Avers | |
| | "Brewster County, Texas Computer Assisted Soil Survey Using Landsat Imagery and Digitized Reference Overlays" - Jack Williams | |
| | "Evaluation of Various Kinds of Aerial Photography for Use in Soil Mapping" Dewayne Williams | |
| 10:00 | Break | |

| | | |
|---|---|---|
| 10:30 | Agricultural Outlook for the 80's | Charles B. Browning |
| | Committee Reports and Discussions | Chairman |
| 11:00 | No. 1 - Use and Interpretation of Soil Survey Characterization Data | Moye Rutledge |
| 11:45 | Lunch | |
| PM 1:00 | No. 2 - Soil Variability and Quality Soil Surveys | Charles Thompson |
| 1:40 | No. 3 - Training Soil Scientists (Academic and Field) | H. H. Bailey |
| 2:20 | No. 4 - Soil Surveys and Land Assessments | B. L. Harris |
| 3:00 | Hall of Fame | |
| 7:00 | Western Dinner and World Soils Tour | |

Thursday, March 20

| | | |
|---|---|---|
| AM 8:00 | No. 5 - Updating Published Soil Surveys | W. M. Koos |
| 8:40 | No. 7 - Soil Survey Educational and Information Program | H. J. Kleiss |
| 9:20 | No. 8 - Coastal Wetlands - Their Classification and Correlation | Arville Touchet |
| 10:00 | No. 9 - Soil Surveys for Woodlands and Their Interpretations | Pete Avers |
| 10:40 | | |
| 11:20 | | |
| 11:50 | | |

# MINUTES OF GENERAL SESSIONS

Bobby T. Birdwell, State Soil Scientist, extended his and Dr. Fenton Gray's personal welcome to the conference and to Oklahoma City.

Roland R. Willis, State Conservationist, welcomed the participants to Oklahoma and discussed the "status" of conservation in the state. He extended best wishes for a productive and worthwhile conference.

Dr. J. C. Murray discussed the outlook for Agronomy Departments in the 1980's. A copy of his presentation is a part of the proceedings.

Dr. Klaus Flach addressed challenges facing the soil survey in the 1980's. Abbreviated comments from his presentation are a part of the proceedings.

Daniel E. Holmes, Assistant Chief (Southwest), discussed reorganization of the National Office noting that it would reduce layering, promote coordination of activities, improve supervision and facilitate response to RCA activities. He also discussed the RCA appraisal and emphasized the following:

1. Cropland conversion to nonagricultural uses.
2. Erosion and that about 3.9 billion dollars needed annually to make meaningful response to soil and water needs.
3. Water pollution affects 95 percent of nation's supply to some degree.
4. Ground water supplies being depleted at about 21 billion gallons per day.
5. Lack of winter food and cover has reduced wildlife habitat in 92 percent of nation to less than one-half of its potential.
6. Other current activities:

    A. National Agricultural Lands Study.

    B. President's Second Environmental Message to Congress.

    C. Farm Program Study.

        (1) Maintain needed food supply

        (2) Sponsor good nutrition

        (3) Source of good for foreign market

        (4) Maintain adequate resource base

        (5) Harris poll

7. Resource areas of concern and logical strategies and policy response.

a. Budget this Administration is projecting indicates increase for the first time in a long time.

Joe Nichols, Head-Soils Staff, discussed the Soils Staff budget and suggested that his office cannot do all that it has been doing. Travel restrictions result in cancelling trips and services to the states. More money has been requested but whether or not it will be available remains to be seen. The lack of Soil Unit staff hampers development of guides for quality control in map units manuscripts, and interpretations. He also noted that additional work and study is needed on:

1. Prime Farmlands
2. Wetlands
3. Soil Potentials
4. Soil Province Map
5. Soil Taxonomy Committee
6. Soil Moisture Relationships
7. Remote Sensing

Joe discussed the Soil Taxonomy Committee's activities and suggested that funds were needed for travel and meetings in order to properly address amendments and other changes in Soil Taxonomy. Membership of the committee was also discussed. New members "elected" to the committee were:

| Federal Members | Term Expires |
|---|---|
| William M. Koos, SCS | March 1983 |
| Pete E. Avers, USFS | March 1984 |

| State Members | Term Expires |
|---|---|
| B. S. Miller | March 1983 |
| Tom Hallmark | March 1984 |

During the closing session Florida's representatives extended and the conference accepted their invitation to hold the 1982 conference in Florida.

The Chairman and Vice-Chairman expressed appreciation to all of the participants for their support and contributions during the last two years and to this conference particularly.

The meeting adjourned at 11:45 a.m., March 20, 1980.

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# AGRONOMY AND AGRICULTURE DURING THE 1980'S

Jay C. Murray

I have tried to sit back and visualize the things that will affect agricultural research in general and along with this the Departments of Agronomy during the 1980's. Since Dr. Gray didn't give me very much direction, I've decided to put most of the emphasis on Research rather than Extension and Teaching. Generally, changes in technology will first come from Research. The conditions that will cause changes in research of the Departments of Agronomy will affect all agricultural agencies. We already have a pretty good picture of what the Departments of Agronomy and our agricultural agencies will be during the 80's. Changes are made by budgets and the 1982 budgets, both federal and state, are already under preparation. This means the complextions of our agricultural agencies are already being molded. Personnel also determine the capability of our agencies. Many of the personnel that will operate the agencies and function in them are already on board. Many will continue to be in these agencies 'throughout the 80's.

We need to be proud to be part of agriculture. Agriculture has a proud tradition and we can only describe its accomplishments as spectacular. Agricultural assets are over $531 billion. Agriculture is the largest source of jobs in the nation, providing over 15 million of them. Agriculture is the nation's largest exporter--with $35 to $45 billion annually. American agriculture provides 50 percent of the grain and 75 percent of the soybeans that are in world trade. American agriculture provides the bulk of the rice that enters into world trade and 70 percent of the food aid. A large part of these accomplishments are due to agricultural sciences. These advances have been so spectacular that one of the main problems facing agricultural research is that of surpluses. However, on the world front we see dark clouds gathering. Research scientists need to look at the world and realize that in a world of free trade both the American farmer and the American consumer are very much a part of the world scene.

The world food situation is serious, even precarious, and that is well documented. The world had a population of only 2 billion in 1930, 3 billion in 1960, and the world reached a population of 4.5 billion last Friday at 1:42 p.m. Man's numbers will easily reach 6 billion shortly after the turn of the century and double in approximately 30 years. Food deficits in many countries are reaching dangerous levels. We might say that food supplies are today where oil supplies were in the 1960's. Just when our demands for food are set to skyrocket, the rise in productivity we had for so many years is faltering. Many of us feel the big reason for this lack of increase in productivity is the result of the lack of support for agricultural sciences during the past 20 years.

Since all of food ultimately comes from crops, it seems appropriate that we agronomists take a look at the situation we are facing.

First, there will have to be a doubling of food production during the next 30 years. During that time we are going to have to do it with less energy, less land, less pollution, less damage to our natural resources and with no more research funding.

These are great challenges. Perhaps these are greater challenges than that of placing the man on the moon or conquering dreaded diseases. The first big challenge is the continued growth of agricultural productivity to meet ever increasing domestic and world demand. Our own population growth and their affluence place increasing and changing demands on agriculture. We're involved in feeding people of both the developed and the under-developed countries. Nations like Japan challenge our industrial superiority. Agricultural exports are increasingly important to meet our balance of payments and this will necessitate our people having to adjust to world market prices. Yet there is evidence that just when we need more growth and productivity, growth is leveling off. We might even be pushing the biological limits of our land. We are running out of the technology needed to bring about continued growth, yet we continue to be asked to maintain productivity growth rates. Just when we are beginning to need more productivity, we are losing both land and farmers. Prime agricultural land is being lost rapidly for commercial and residential uses and farmers are being lost to competing occupations that offer more stability and more secure incomes.

The costs and availability of production inputs are major obstacles. Our resources are declining and costs are escalating. Energy is a major problem. Just having energy available is a constant concern and energy costs are threatening to obliterate already razor-thin margins for producers. The entire nation is now beginning to feel what the West has always known, that water will ultimately be the limiting factor in agriculture.

As you know, when we increase our demands on existing agricultural lands and expand into marginal lands, the need for water increases. We are already diminishing our water supplies across the country. We can expect rapidly growing competition for use of scarce water among agriculture, urban and industrial users.

Chemicals pose another problem for the future of agriculture. Many fertilizers are either petroleum based or require considerable energy for their manufacture. Consequently, their future availability and costs must be considered. Pesticides also require energy and cause environmental concerns.

Environmental and health constraints add greatly to the problems. Even though regulations for health, safety, and environmental purposes are often valid, nevertheless they limit the flexibility and ingenuity of our farmers. We can anticipate continued pressure to ban and control pesticides and herbicides whenever there is even the slightest suggestion that they might be harmful to the environment or hazardous to health. As it becomes more and more difficult to obtain clearances for the use of chemicals, fewer companies are going to be willing to take the risk of developing chemicals which may be ruled unsafe later after tremendous financial outlays have been made for their development. There will be increasing pressure on farmers to assure that their efforts to improve productivity do not come at the expense of land fertility and air and water quality.

Also, agriculture will be greatly affected by the economy and what the Federal government and politics do. We as scientists do not pay enough attention to the area of politics, when in fact, these are some of the biggest problems with which we must contend.

Generally speaking, as inflation continues to skyrocket there will be pressure to reduce governmental budgets. There is bound to be considerable discussion concerning appropriate roles of government and private sectors for research.

In the past, there has been considerable political support for agricultural research. However, as the influence of rural areas and their representation shift to metropolitan areas, agriculture and agricultural research will lose some of its power base and we will be required to form new support bases.

Working with people who do not understand agriculture will not always be easy. For instance, when beef prices rose several years ago and the consumers organizations protested rather loudly, one agricultural research official was summoned to the White House. The White House staff wanted to know what an increase of $1 million in agricultural research funding would to to the price of beef? When the official indicated that it would not change the price of beef any, he was then asked what a $5 million increase for research would do, and so on up to $100 million. He then explained that agricultural production cannot be turned off and on, that the beef herds would have to be increased, and that this would take years. He explained that the pasture, the ranges, and the feed grain supplies would have to be geared up. I think this illustrates very well the lack of understanding and the expectations of those large numbers of people who are completely unacquainted with agriculture--people who are going to be responsible for many of our policies.

Now, what does this all mean for agricultural research, extension, teaching, the departments of agronomy and our agricultural agencies: First, we will need to intensify our efforts to increase productivit There is evidence that we are running out of technology on which future productivity depends. Some feel this is the result of gradual decline in basic research designed to develop knowledge for future agricultural developments. Hopefully it will be possible for agronomy departments to avoid letting short-term problems get all of the attention and that they will be able to move more into basic research that will provide the basic knowledge necessary to develop future agricultural practices and technology. There is considerable pressure in the Congress and other parts of government to move to more basic research policies and to open up the agricultural research funds to the entire scientific community. This will mean the Department of Agronomy will have to compete with Biology Departments in all private and public institutions for the limited funding available. This is already taking place to some extent. A big worry in this area is that people who are in the government and making the decisions will most likely not have very much background in agriculture.

Areas that are being talked about as appropriate for these basic research studies are environmental stress, cell regulation disease and insect resistance, genetic manipulation including recombinant DNA, water efficiency in plants, nutrient quality of foods, photosynthesis, and nitrogen fixation.

Secondly, the research will need to include studies that will increase productivity while conserving the resources. Perhaps the most difficult challenge facing agricultural research and education and which will fall squarely on the Departments of Agronomy is the need for agriculture to increase productivity while conserving precious resources. Soil conservation is an example. When demand is high for agricultural products and prices are high, there is a tendency to take shortcuts, to farm every inch, and to push the soil to the limits of its productivity. This puts the land at risk. The research challenge will be to develop methods of protecting existing lands against such erosion and to permit the productive use of these marginal lands.

Along with soil conservation will be energy conservation. This will be a most difficult challenge for agronomic research. Our great growth in American agricultural productivity has been based on an abundance of cheap energy. Now availability of energy is dwindling and prices are soaring and we may be faced with developing whole new ways of farming which require drastically reduced energy inputs. This will require close cooperation with other disciplines such as agricultural engineering.

In the long run, water conservation will become more important. As water supplies become even more scarce! the research challenges are clear. We must develop crops and varieties that require little water and grow well on marginal lands. We will need to work with engineers to refine irrigation technology and explore ways to recover and recycle water with minimal inputs, Third, our research will need to include ways of protecting the environment. We could do all of these things much easier if we did not have to worry about the environment. This will mean new methods of pest control using fewer chemicals. Research can help develop new, effective chemicals that are safer on the environment and will need those helps to prevent soil erosion.

Now, all of these things will have to be done with little or no increase in funding for research and education. Research and education funding has been declining for over 20 years. Even if we are able to turn this around, there will not be enough money to fund all projects. There will be an increasing need to make tough decisions and hard choices. We will have to pay more attention to identifying the problems, setting research priorities and selecting the most appropriate mechanism for conducting and supporting the research. There will be increasing emphasis on the quality of the research, which might be enforced through funding through competitive grants. We will need to increase our communication with the life sciences. Agricultural scientists will have to put more effort into being more comprehensive and intensive in studying the problems facing agriculture. We will be required to prioritize and research those problems first that are most important to agriculture. These evaluations will have to include farmers and users.

Once the priorities have been set and the problems identified, the scientist is going to have to ask if they are researchable and if so, how. He will also have to determine if the research methodology is available, who should do it, and can results be expected. Only the scientist can answer these questions.

The quality of the projects is not so important in times of abundance, but in times of scarcity, every dollar must count. One important resource will be to terminate poor quality projects and then focus the freed funds on the best quality research. Agronomy departments, like all agricultural research departments, will have to focus on quality and quality control. We are already seeing this, but it is going to be necessary to accelerate it and evaluate the output of the scientific programs and the project outputs and of the performance of the individual scientist.

You can see that I am suspecting stricter and leaner operations for Colleges of Agriculture. It is hard to see how fast this will come, but it will probably be done through the budget process, and when you see how fast the President can retrieve a budget shortly after submitting it in order to drastically overhaul it, as President Carter has recently done, you see that it can happen fast. The 1982 budgets are now in preparation. I think Departments of Agronomy should now start evaluating the problems and moving in the direction to cope with reduced funding. We have some real challenges. Associated with these challenges are some difficult realities, yet I feel it will be an exciting time for the agricultural scientist. The job of the agricultural scientist will be increasingly important, even though there seems to be little doubt that resources will be harder to come by. We have the opportunity to provide the leadership and the expertise in the area of most fundamental importance to society. That is -- food production. It is indeed going to be exciting to be part of such an awesome and important responsibility and to have the opportunity to provide such an essential service to our fellow man.

# SOIL SURVEY CHALLENGES IN THE 1980'S

The following is a summary of Dr. Flach's general address to the conference.

1. The budget will be tight. There may be a slight increase but with inflation the level has been about the same since 1971.

2. Personnel ceilings and freeze on hiring dictate that only one out of two vacant positions can be filled.

3. The National Office is undergoing reorganization and in reality it's back to where it was about three years ago.

   A. Soil Survey in the Office of the Deputy Chief for Natural Resource Assessments (Bill Johnson)

   B. Soil Survey Staff reorganization

      (1) Soil Survey Research Coordination

      (2) Soil Survey Technology

      (3) Soil Survey and Correlation

   These separate management and administration, technical and quality control functions.

4. Progress in NCSS in FY 1979

   A. SCS mapped 54 million acres; Cooperators mapped 13 million acres.

   B. State of Connecticut completed.

   C. Published 133 soil surveys

      (1) Need about 200 surveys in the pipeline for publication.

      (2) Objective is to publish withi 2 years of completion. About 40 percent of the delay is in map compilation and finishing in the states.

5. Soil potentials are being prepared and working - mainly in the south!

6. Special projects

   A. Soil Operations Data (SOD) file

   B. Map unit use file

   C. Soil moisture regime cooperative study with NASA.

   D. AGRISTAR

   E. Pedon Data Record is progressing.

   F. Cadmium-Lead study

7. Important projects being pursued.

   A. AID contracts to provide:

      (1) Soil taxonomy assistance.

      (2) Soil survey program planning for other counties.

   B. Tropical soil specialist for the National Soil Survey Laboratory.

   C. Placing more soil scientists on special projects for closer ties between research and soil survey.

      (1) Blake Parker - F&WS

      (2) Larry Ratliff - SEA

   D. Cooperate with BLM and FS on soil surveys of public lands in the west.

The following comments were made in his addressing the "Challenges of the 1980's".

1. Citing Phillip Handler's comment that "tomorrow, if we are to continue to live on this globe together, we must establish a stable permanent relationship with our basic resources" he noted that this will be one of the greatest challenges of the 80's and suggested that soil surveys are important to this relationship.

   A. The people need to know.

   B. We must develop their support.

   C. Surveys must meet 1980 standards.

   D. Soil classification and morphology must he at center of concern.

2. To determine soil resource base we must complete the once-over soil survey - needed now!

3. Maps are for many purposes.

   A. Will continue traditional operations but optimize mapping detail with needs, and with least expense of energy.

   B. Need to update 20 to 30-year old surveys to 1980-1990 standards. We must do as little remapping as possible but update out-of-date survey by remapping best land where poor surveys exist.

   C. Updating must be done efficiently.

4. Characterization and descriptions of map units must be improved.

   A. Determine composition of map units and tell where the components occur on the landscape.

   B. Develop soil behavioral data including erosion and fertility data.

   C. Research soil genesis to establish the relationships between soils and their environment.

5. Soil Taxonomy

   A. We "dropped the ball" in about 1972.

   B. Tremendous international interest.

   C. Changes needed for use in tropics.

   D. Propose a new edition in 1985.

   E. FAO planning meeting in near future to agree on basic parameters for soil classification.

6. Soil survey is "kingpin" in soil science discipline and not an "academic appendage" to soil chemistry, fertility, etc.

   A. Transfer research finding to other areas through soil survey.

   B. Cornerstone in assessing natural resources.

   C. Qualification of soil scientist will change drastically in this decade.

   D. Need to emphasize soil scientists in soil technology and deemphasize mapping per se.

7. Public support

   A. Soil surveys cost money.

   B. Public needs to know that soil surveys are important and that investment of public money is wise investment.

   C. Need greater public participation in soil surveys including beginning planning.

   D. Need to broaden public participation in state annual soil survey work planning conferences.

COMMITTEE I - Use and Interpretation of Soil Survey Characterization Data

Chairman: E. M. Rutledge

Vice-Chairman: L. A. Quandt

Members: L. C. Brockman* P. L. Lorio* M. E. Schaffer
S. W. Buol* Warren Lynn
B. F. Hajeck B. J. Miller

Charges:

1. Make an inventory of the:

    A. Laboratories in the region providing soil characterizational data.

    B. Kinds of data being generated.

    C. Procedures being followed that are different from National Soil Survey Laboratory procedures.

    D. Uses being made of data.

2. How to better utilize data in classification and correlation.

3. Explore methods of making data available.

Committee Report:

Charge 1: Regarding inventory of kinds and use of laboratory data. L. A. Quandt, leader.

The various characterization laboratories within the region were contacted regarding the determinations which they routinely make. This information is contained in Table 1. A brief description of these procedures follows. (Method notations refer to the 1972 edition of "Soil Survey Investigations Report No. 1. Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples" by the Soil Conservation Service and published by the U. S. Government Printing Office. Some more recent methods are available only at the National Soil Survey Laboratory.)

Particle Size Analysis: Proportions of the various sizes of particles in a soil. Most of the laboratories remove organic matter by hydrogen peroxide (3A1). The dispersing of the soil sample is with sodium metaphosphate. The method of

*Not present at conference.

fractionation and particle size analysis is usually limited to sieving of particles between 0.05 mm and 2 mm and the 0.05 mm particles by sedimentation procedures. The pipette method utilizes sampling of the suspension at controlled depths and times (3A1a). The hydrometer method represents the suspension density. The hydrometer method is used by many states and is sufficient for most purposes but considered less accurate than the pipette method by some researchers.

Moisture Tensions: Several states are collecting saran coated natural fabric samples of selected horizons while sampling pedons for complete characterization analysis. The 1/3-bar and 1/10-bar tensions (4B1c) are determined from the natural fabric samples and the 15-bar tension (4B2a) is determined from the fine-earth fraction. Moisture release curves indicate a strong need for 1/10-bar data for sandy and coarse-loamy soils. The water retention difference is the water content between a sample at 1/3-bar or 1/10-bar tensions and a sample at 15-bar tension. A summary of water retention data of the major soils in the south region should be utilized to update guides for determining available water capacity and also for updating future revisions of the SOILS-5.

Bulk Density: The volume of a given mass of soil depends on its water content therefore the moisture condition is designated when the measurement is made. The bulk density measurements are normally determined for the same horizons selected for water retention differences (4A1d, 4A1h). In many states the COLE values are determined by the survey party by measuring the change in core or clod dimension from a moist to a dry state.

Mineralogy: Most of the states are obtaining X-ray diffraction (7A2i) data of soil clays at the University laboratories or requesting the data for samples sent to the NSSL. The data is normally obtained for selected horizons of the control section for the major soils. Differential thermal analysis (7A3) method is used by few states. Most of the states are making optical analysis (7B1a) of major soils. A good procedure is to mount the very fine sand or fine sand on a glass slide and make an initial determination of the minerals present and then forward the slide to the NSSL for their analysis of minerals and other grains. This procedure coordinates the states soil investigations program with the liason person at the NSSL.

Organic Carbon-Organic Platter: Organic carbon is determined in most states by two methods: 1) quantitative combustion (dry) procedures (6A2b), wherein C is determined as CO2 and 2) acid dichromate digestion (6A1a) is based on the reduction of $Cr_2O_7^{2-}$ ion by organic matter, wherein the unreduced

$Cr_2O_7^{2-}$ is measured by titration. Organic carbon in calcareous soils is determined by wet combustion. The organic matter is determined by multiplying the weight of organic carbon by 1.724.

Reaction: The majority of states are determining pH by a glass electrode in 1:1 or 1:2 soil water (8Cla) mixture. Some states are also determining pH of soil in a 0.01 molar solution of calcium chloride (8Cle) or in a solution of KCl (8Clg).

Extraction of Bases: Is determined by 1) NH4OAc, corrected-exchangeable (5B1b) 2) NH4OAc, pH 7.0 revised corrected-exchangeable (5B4b) 3) NH4OAc, pH 7.0 leaching tube (5A6) 4) rapid determination of exchangeable bases acidity and base characterization, Hajek, B. F., Adams, F. and Cope, J. T. Jr. 1972 Soil Sc. Amer. Proc. 36:436-438.

Measurement of Bases: The total amount of potassium (6Q2b), calcium (6N2e), magnesium (6O2d) and sodium (6P2b) extracted from the soil sample by ammonium acetate at pH 7.0 is determined by atomic absorption (5B1) method in all states in the south region.

Extractable Acidity: Is determined by using a barium chloride-triethan-olamine I and II pH 8.2 and back-titrate with HCL (6H1a) (6H2a).

Base Saturation: Two methods are used by most states: 1) sum of NH4OAc, pH 7.0 extracted bases divided by cation exchange capacity (5C1) 2) divide sum of NH4OAc extracted bases by sum of cations determined by TEA, pH 8.2 and bases by NH4OAc, pH 7.0 (5C3). The first method gives the higher base saturation values.

Cation Exchange Capacity: Three methods are used: 1) direct distillation of absorbed ammonia, Kjeldahl (5A1a) 2) sum of cations, acidity by Ba-C12-TEA, pH 8.2, bases by NH4OAC, pH 7.0 (5A3a) 3) sum of bases plus Al (5A3b) extract and extractable acidity by TEA extract.

Other Ions: Iron is determined by five methods: 1) dithionite-citrate extraction, orthophenanthroline colorimetry (6C2a) 2) dithionite-citrate extraction, atomic absorption (6C2b) 3) dithionite-citrate-bicarbonate extraction, potassium thiocyanate colorimetry (6C3a) 4) sodium-pyrophosphate extraction I, atomic absorption (6C5a) 5) sodium-pyrophosphate extraction II, atomic absorption (6C8a).

The aluminum content in soils is determined by many different methods: 1)KC1 extraction 1, 30 min. aluminon I (6G1a), aluminon II (6G1b), flouride titration (6G1d), atomic absorption (6Gle) 2) KC1 extraction II, overnight, aluminon I (6G2a)

3) sodium pyrophosphate extraction I, atomic absorption (6G5a) 4) dithionite-citrate extraction I, atomic absorption (6G7a) 5) KCL automatic extractor, atomic absorption (6G9a).

The sulfur content is determined by 1) NaHC03 extract, pH 8.5, methylene blue colorimetry (6Rla) 2) Leco sulfur analyzer 3) sulfide plus sulfate, and Nearpass, 1960.

The total phosphorus in soils is determined by 1) perchloric acid digestion, molybdovanadophosphoric acid colorimetry (6Sla) 2) Bray I 3) Bray II.

Engineering Test Data: Most of the states are utilizing the services of the state highway and transportation engineering laboratories to determine atterberg limits, percent passing various sieve sizes and optimum moisture data. They also provide the unified and ASHTO classification of soils.

Interpolation of Laboratory Data: In many cases complete characterization data is not available for classification or correlation of soils. This will require the interpolation of data available to determine classification of the soil. This can be illustrated with the following example: mineralogy is needed for correct classification of a new series and X-ray diffraction data is not available. The attached "Nomograph For Estimating Clay Mineralogy of Soils From Their Clay Content and Cation Exchange Capacity" will provide some estimate of the mineralogy (Fig. 1). We should use related data as much as possible to assist in our classification of soils.

Charge 2: How to better utilize data in classification and correlation. E. M. Rutledge, leader.

The data that are available for classification and correlation are well utilized. The process could be enhanced by having a data storage and retrieval system which would insure that all relevant data were available when needed. This aspect will be developed under the following charge.

The committee considered the possibility of enhancing the utilization of resources committed to data aquisition:[1/]
(1) Data are generally more helpful if obtained early in the process of a survey. It is suggested that initial sampling utilize satelite (or incomplete pedon) sampling to establish ranges and central concepts of critical properties. More complete characterization sampling should be initiated as soon as central concepts are adequately identified. It is urged that sampling be done early enough to allow additional sampling in case the data conflict with preconceived ideas or raise unforeseen questions.

1/ This discussion is limited to data collected for classification and correlation purposes.

(2) Use of geomorphic information in site selection could, in some cases, result in more meaningful and useful samples.
(3) Some workers suggest analyses be more specific for each pedon; that only those analyses be performed which are needed to answer the specific questions at hand. Others point out that considering the resources committed to the pedon in site selection and sampling, more complete analysis is justified since we cannot envision all future uses for the data.
(4) Our data are primarily for classification and correlation. The committee feels we should consider data related to interpretations. We recommend a committee at our next conference be charged to "Identify and evaluate laboratory measurements that relate to plant growth and productivity." We especially recommend evaluation of Na and Al contents as related to production of major agronomic crops. We also recommend evaluation of K and P release rates. In general, the committee suggests evaluation of parameters which might someday be useful in developing productivity guides. It is noted that the Canadians have productivity guides which could be helpful to the next committee.
(5) Consideration should be given to presenting supporting data on one or more pedons before establishing a new series. Some workers suggest sampling three pedons and having two pedons of supporting data. Other workers point out that this is not feasible because of insufficient laboratory resources. Also, a requirement of this nature could repress the establishment of needed series.

Charge 3: Explore methods of making data available.
Warren Lynn, leader.

Three methods of data publication are suggested.

(1) Soil Survey Investigations Reports (SSIR) on compilations of data by state experiment stations. (A repository for all data and descriptions; classification of pedons is desirable).
(2) Published Soil Surveys (data to document principal soils). Narrative discussion or interpretation of data encouraged. Two examples are appended.
  a. Iberia Parish, Louisiana - includes narrative sections on nature of materials and interpretation of data.
  b. Red Rose - Washoe Bay Area, Manitoba, Canada - illustrates a format where series typifying pedon descriptions and data are printed together.
(3) Pedon Data Subsystem (a computer storage and retrieval system).

Status Report:

Engineering data - Existing files - entered with SCS-Soils-5: 1620 pedons and 5440 horizons for soils in the south. Pedon Descriptions - encoded via mark-sense forms. Used for NSSL sampling and for contract encoding of descriptions. Data on pedons that have been classified (SCS-Soils-8 forms completed by state and concurred in by TSC soils staff). The program is written to enter the data. Debugging expected to take 6 to 12 months. State experiment stations with data in some computer format are encouraged to consult and/or visit NSSL personnel to develop programming that will convert data to the Pedon Data Subsystem.

Summary:

The publication of data and descriptions is strongly encouraged. Information not made public is information lost to some degree. The three methods suggested provide (1) means of immediate publications, (2) appropriate illustration and documentary support for Soil Survey Reports and (3) the potential for access to a large repository of data and description through computer storage and retrieval.

Recommendations:

Charge 1: Regarding inventory of kinds and use of laboratory data. L. A. Quandt, leader.

The desired information is presented in the previous section. The charge is not suited to specific recommendations.

Charge 2: How to better utilize data in classification and correlation. E. M. Rutledge, leader.

Data that are available are well utilized. The problem is the availability of data. Data availability are discussed under Charge 3. Approaches to data acquisition are discussed. It is recommended that a committee of our next conference be charged to "Identify and evaluate laboratory measurements that relate to plant growth and productivity." More specific information is presented in the discussion.

Charge 3: Explore methods of making data available. Warren Lynn, leader.

It is recommended that data be published in soil survey reports, in computations by states and/or in Soil Survey Investigation Reports and entered into the Pedon Data Subsystem.

TABLE 1, SUMMARY OF LABORATORY PROCEDURES FOR SOIL CHARACTERIZATION - continued

| STATE | Ext. of bases | Measurement of bases - At. Absorp. | | | | Ext. Acidity | | Base Saturation | | Cation Exchange Cap. | | | Other Ions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $NH_4OAc$ | Ca | K | Mg | Na | $BaCl_2$-TEA | | $NH_4OAc$ | Sum. | $NH_4OAc$ | Sum. | Sum. + Al | Fe | | Al | | S | P |
| NSSL Method | 5B1b | 6N2e | 6Q2b | 6O2d | 6P2b | 6H1a | 6H2a | 5C1 | 5C3 | 5A1 | 5A3a | 5A3b | 6C2b | 6C8a | 6G7a | 6G7a | 6R1a | 6S1a |
| Alabama | 1/ | x | x | x | | x | | x | | x | | | + | | | x | | |
| Arkansas | 5A6 | x | x | x | x | x | | | x | + | x | + | | | | | | |
| Florida | 5B4b | x | x | x | x | x | | | x | | x | x | x | 6C5a | x | 6C5a | 2/ | |
| Georgia | x | x | x | x | x | | | | x | x | | | | | 6G1 | | | |
| Kentucky | x | x | x | x | x | x | | x | x | x | | | | | 6G1d | | | Bray I |
| Louisiana | x | x | x | x | x | x | | x | x | x | x | x | 6C3a | | 6G1 | | x | |
| Mississippi | x | x | x | x | x | x | | | x | | x | | 6C3a | | 6G1b | | x | x |
| North Carolina | x | x | x | x | x | x | | x | x | x | x | x | x | | 6G1e | | 3/ | Bray II |
| Oklahoma | x | x | x | x | x | x | | x | x | | x | | 6C2a | | x | | | |
| South Carolina | x | x | x | x | x | x | | | x | | x | | x | | 6G1e | | | |
| Tennessee | | x | x | x | x | x | | | x | | x | | | | | | | |
| Texas | 5A6 | x | x | x | x | | 6H2b | + | + | | + | | + | | | x | | |

x University Laboratory data in each state. Same method as NSSL unless otherwise noted.
\+ National Soil Survey Laboratory data
1/ Rapid determination of exchangeable bases acidity and base characterization, Hajek, B.F., Adams, F. and Cope, J. T. Jr., 1972 Soil Sc. Amer. Proc. 36:436-438
2/ Leco sulfur analyzer
3/ Sulfide plus sulfate, Kilmer and Nearpass, 1960
5A6 etc. Soil Survey laboratory methods and procedures that differ from column heading - some of these procedures are not presently listed in Soil Survey Investigations Report No No. 1, April 1972

TABLE 1. SUMMARY OF LABORATORY PROCEDURES FOR SOIL CHARACTERIZATION

| STATE | Particle size: Seive | Particle size: Hydro | Particle size: Pipet | Moisture tensions: 1/10 | Moisture tensions: 1/3 | Moisture tensions: 15 | Bulk density: 1/3 | Bulk density: dry | COLE | Mineralogy: x-ray | Mineralogy: DTA/DSC | Mineralogy: optical | Organic Matter & Carbon: Digestion | Organic Matter & Carbon: Combustion | pH: $H_2O$ | pH: $CaCl_2$ | pH: KCl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NSSL method | 3A1 | | 3A1a | 4B1c | 4B1c | 4B2a | 4A1d | 4A1h | 4D1 | 7A2 | 7A3 | 7B1a | 6A1a | 6A2b | 8C1a | 8C1e | 8C1g |
| Alabama | x | | x | + | + | + | | | | x | x | x | | | x | | |
| Arkansas | x | x | | + | + | + | + | + | + | + | | + | | x | x | | |
| Florida | x | | x | 4B1d | 4B1d | x | 4A3 | 4A3 | | 7A2d | | | x | | x | x | 8C1c |
| Georgia | x | x | | | x | x | | | | x | x | | x | | x | x | |
| Kentucky | x | | x | | | | x | | | x | | | x | | x | | 8C1e |
| Louisiana | x | x | | + | x | x | x | x | + | x | x | x | x | | x | x | |
| Mississippi | x | x | | | x | x | | x | | + | | + | x | | x | | x |
| North Carolina | x | x | x | | | | x | x | x | x | x | x | x | | x | x | x |
| Oklahoma | x | x | + | | + | + | | + | + | x | | x | x | | x | | |
| South Carolina | x | | x | | | | | | | 7A2a | x | x | | x | x | x | |
| Tennessee | x | x | x | | | | | | | x | x | x | | | x | x | |
| Texas | x | | x | + | + | + | + | + | + | x | | + | | 6A1c | x | + | |


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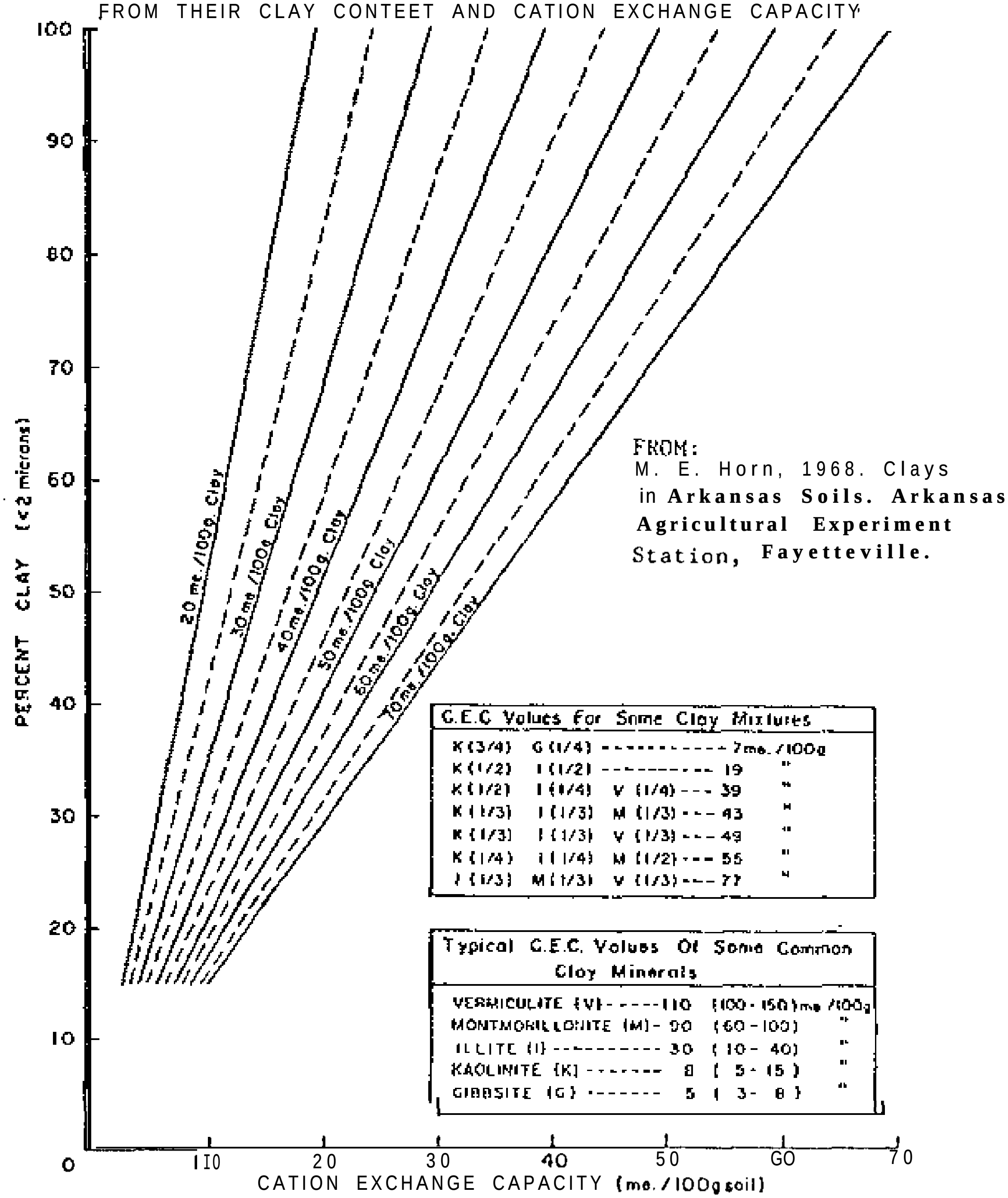
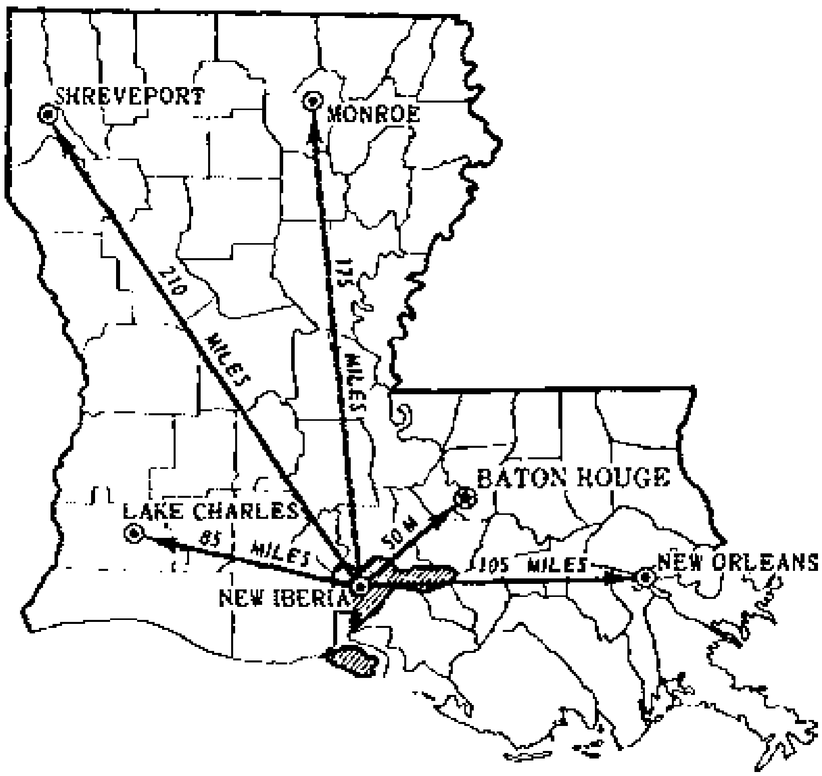
**Figure 1:** NOMOGRAPH FOR ESTIMATING CLAY MINERALOGY OF SOILS FROM THEIR CLAY CONTEET AND CATION EXCHANGE CAPACITY



**Committee 1: Use and Interpretation of Soil Survey Characterization Data**

**Appendix No. 1**




Stale Agricultural Experiment Station at Baton Rouge

Location of Iberia Parish in Louisiana.

# SOIL SURVEY OF IBERIA PARISH, LOUISIANA

BY HENRY L. CLARK AND ALMOSD G. WHITE, SOIL CONSERVATION SERVICE
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table 8). A more Obvious evidence of the downward movement of clay is the presence of clay films on the structural surfaces in the B2t horizon of many soils. Baldwin, Patoutville, and Frost soils are good examples of soils that have a well-defined B2t horizon within which clay films are on the faces of peds.

The formation of organic soils is not attributed to the above mineral soil-forming processes. Organic soils formed in organic material that accumulated under saturated or flooded conditions. The organic material gradually accumulates and thickens as low coastal land areas subside and the sea level rises.

## Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys. allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; and in planning engineering projects. The broad categories of classification facilitate study and comparison in large areas such as countries and continents

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*23*). Because this system is under continual study. readers interested in developments of the current system should research the latest literature.[5]

The current system of classification has six categories. beginning with the broadest, these categories are *order, suborder, great group, subgroup, family,* and writs. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties chosen are those that result in the grouping of the soils of similar mode or origin In table 7, the soil series of Iberia Parish are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, both of which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol*. Inceptisol is an example.

SUBORDER. Each order is divided into suborders on the basis of soil characteristics that result in grouping soils according to genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The properties considered are mainly those that reflect either the presence Or absence of waterlogging or the soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquept* (*Aqu*. meaning water or wet. and *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of uniformity in the kind and sequence of major soil horizons and features. The horizons considered are those in which clay, iron, or humus have accumulated; those in which pans interfere with growth of roots, movement of water or both ; and those in which thick, dark-colored surface horizons have formed. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The name of a great group has three or four syllables and is made by adding a prefix to the name of the suborder. An example is Haplaquept (*Hapl*, meaning simple horizons, *aqu* for wetness or water, and *ept*, from Inceptisol ).

SUBGROUP. Each great group is divided into subgroups, One representing the central (typic) segment of the group, and others, called intergrades, having properties of the group and also one or more properties of another great group, suborder, or order. Subgroups are also established if soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Vertic Haplaquepts (a cracking Haplaquept).

FAMILY. Families are established within each subgroup, primarily on the basis of properties important to the growth of plants or on the behavior of soils when used in engineering structures. Among the properties considered are texture, mineralogy, reaction, temperature, permeability, thickness of horizons, and consistence. A family name consists of a series Of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on. An example is the very fine, montmorillonitic, acid, thermic family of Vertic Haplaquepts.

SERIES. A series is a group of soils that formed in a particular kind of parent material and have genetic horizons that, except for texture of the surface layer, are similar in characteristics and in arrangement Of layers in the soil profile. Among the characteristics are color, structure, reaction, consistence, and mineral and chemical composition.

## Laboratory Data[6]

Data are collected on soils to catalogue soil prop-

[5] See chapters 3, 4, 8, 10, 12, 13 and 18 in the unpublished working document "Selected Chapters from the Unedited Text of the Soil Taxonomy" available in the SCS State Office, Alexandria La

[6] This section was prepared by WARREN C. LYNN, soil scientist, Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

TABLE 7.—*Soil series classified according to the current system of classification*

| Series | Family | Subgroup | Order |
|---|---|---|---|
| Alligator[1] | Very fine, montmorillonitic, acid, thermic | Vertic Haplaquepts | Inceptisols. |
| Andry | Fine-silty, mixed, thermic | Typic Argiaquolls | Mollisols. |
| Baldwin | Fine, montmorillonitic, thermic | Vertic Ochraqualfs | Alfisols. |
| Calhoun | Fine-silty, mixed, thermic | Typic Glossaqualfs | Alfisols. |
| Convent | Coarse-silty, mixed, nonacid, thermic | Aeric Fluvaquents | Entisols. |
| Coteau | Fine-silty, mired, thermic | Glossaquic Hapludalfs | Alfisols. |
| Delcomb | Loamy, mixed, euic, thermic | Terric Medisaprists | Histosols. |
| Fausse | Very fine, montmorillonitic, nonacid, thermic | Typic Fluvaquents | Entisols. |
| Frost[2] | Fine-silty, mixed, thermic | Typic Glossaqualfs | Alfisols. |
| Gallion | Fine-silty, mixed, thermic | Typic Hapludalfs | Alfisols. |
| Galvez | Fine-silty, mixed, thermic | Aeric Ochraqualfs | Alfisols. |
| Iberia | Fine, montmorillonitic, thermic | Vertic Haplaquolls | Mollisols. |
| Jeanerette | Fine-silty, mired, thermic | Typic Argiaquolls | Mollisols. |
| Lafitte | Euic, thermic | Typic Medisaprists | Histosols. |
| Loreauville | Fine-silty, mixed, thermic | Udollic Ochraqualfs | Alfisols. |
| Maurepas | Euic, thermic | Typic Medisaprists | Histosols. |
| Memphis | Fine-silty, mixed, thermic | Typic Hapludalfs | Alfisols. |
| Newellton[3] | Clayey over loamy, montmorillonitic, nonacid, thermic | Aeric Fluvaquents | Entisols. |
| Patoutville | Fine-silty, mixed, thermic | Aeric Ochraqualfs | Alfisols. |
| Perry[4] | Very fine, montmorillonitic, nonacid, thermic | Vertic Haplaquepts | Inceptisols. |
| Placedo[5] | Fine, montmorillonitic, nonacid, hyperthermic | Typic Fluvaquents | Entisols. |
| Satlake | Very fine, montmorillonitic, nonacid, thermic | Typic Hydraquents | Entisols. |
| Sharkey | Very fine, montmorillonitic, nonacid, thermic | Vertic Haplaquepts | Inceptisols. |

[1]The Alligator soils in mapping unit Ag are taxadjuncts to the Alligator series because their A horizon is black. The Alligator soils in mapping units At and Ax are taxadjuncts to the Alligator series because their A horizon is black, they are extremely acid in the upper 10 inches, and they are strongly acid between depths of 10 and 24 inches.

[2]The Frost soils in mapping unit Fr are taxadjuncts to the Frost series. They

sium chloride-triethanolamine extract is used for calcium and magnesium when solid carbonates are present. Instrumental analyses are the same as those for soluble cations. Values have been corrected for soluble salts.

*Extractable acidity* (6H1a) is determined by using a barium chloride-triethanolamine (pH 8.2) extract.

*Fiber content by volume* is the percent of sample retained on a 100-mesh (0.15-millimeter openings) sieve. An unrubbed sample is washed through the sieve under a stream of water until the effluent is clear. A rubbed sample is rubbed between thumb and forefinger during the washing process.

*Mineral content* is the residue left after the sample is heated overnight at 400°C.

*N-value* is the grams of water associated with one gram of clay.

*Organic matter* is the weight of organic carbon (6A1a) dissolved by chromic acid digestion and multiplied by a factor of 1.724.

*Particle size* (3A1) is determined by the pipette method.

*Reaction* is determined by a glass electrode in 0.01 molar solution of calcium chloride.

*Residue* is the proportion of the original thickness remaining. The undried sample never became air dried. The dried sample was air dried and remoistened. Only the mineral component remains in the minimum sample. All organics are dissipated.

*Resistivity* (8A2) is the electrical resistance of a saturated soil paste in a standardized cell.

*SAR* (5E) (sodium absorption ratio) is an estimate of the potential sodium hazard.

*Soluble anions* (8A1) are determined by using the extract from a saturated soil paste.

*Soluble cations* (8A1) are determined by using the extract from a saturated soil paste.

*WRD* (water retention difference) (4C1) is the difference in water content between an undisturbed sample at 1/3-bar moisture tension and a disturbed sample at 15-bar moisture tension. *Undried* means samples for a 1/3-bar and 15-bar tension were not previously air dried. *Dried* means the 1/3-bar moisture content was measured for clods that were air dried and rewet. The 15-bar moisture content was measured on air-dried material.

### Nature of the organic soil material

The bulk of the organic material builds up from the residue of hydrophytic grasses, sedges, and forbs, and is preserved by the reducing conditions prevalent in marshes and swamps. To a depth of 1 foot, the organic soil contains a mat of live roots. Most of the organic soils in Iberia Parish are in saline marshes, which are gradually encroaching landward through regional subsidence and a rise in sea level. Freshwater marshes and swamps are changing to saline marshes.

The organic soils in Iberia Parish are well decomposed compared with organic soils in other areas of the United States. Rubber fiber, a measure of physical stability, is less than 10 percent of the original volume, except in the surface root mat. Solubility in sodium pyrophosphate, a measure of chemical instability, is indicated by the dark Munsell color notations. Stable material has a Munsell value of 7 or more and chroma of 2 or less.

Organic soils have low bulk density in the undrained or natural state. The bulk density increases after drainage, but is still low compared with that of mineral soils. Water content is inversely related to the bulk density, especially in organic soils. The lower the bulk density, the higher the water content. The listed percentage figures may seem unreasonably high, but this is because the value is really a ratio of the weight of water to the weight of oven-dry solid material, and not a true percentage.

Organic soils have a higher exchange capacity than mineral soils. Because of the low weight of the organics, however, the number of exchange sites available in a given volume of material is not too different from that of mineral soils. Exchangeable cations reflect the saline water system, and higher proportions of magnesium and sodium than is common are found in upland soils of the region. Base saturation is more than 90 in most samples. Resistivity and electrical conductivity values also indicate saline water conditions.

### Nature of the mineral soil material

Mineral soil material beneath the organic soils was sampled for analysis. Memphis soil on Avery Island was sampled for comparison of particle size and the kinds of clay minerals,

The mineral soils, with three exceptions, have similar particle-size distributions. Clay content is about 20 to 35 percent. Sand content is less than 2 percent. The distribution is consistent with that of loess. The mineral material in Lafitte S69La-23-4 is high in clay. This suggests an alluvial deposit associated with the Mississippi River distributary system.

The relatively high sand content in Andry S69La-23-2 results from carbonate cementation. The higher sand content in the IIB3 horizon of Memphis S69La-23-11 indicates at least an admixture of material other than loess.

In the shallow organic soils, several mineral layers were sampled. The clay distribution in the successive layers is consistent with the presence of an argillic horizon and the associated eluvial horizon, such as that found in Jeanerette soils.

The pH of both mineral and organic soils reflects the influence of saline water. The pH is essentially the same in water and in 0.01 molar calcium chloride, and there is little decrease in pH upon drying. No acid sulfate soils should develop upon drainage.

Clay minerals of mineral soils beneath the marsh fall into three categories, depending on the type and amount of smectite, which is a group name for expanding clays, including montmorillonite. Delcomb S69La-23-6 and S69La-23-9 have small amounts of poorly ordered smectite much like the Memphis S69La-23-11 on Avery Island and like a pedon of a Memphis

TABLE 8.—*Physical and chemical*

[Numbers for the various test methods are shown in parentheses

| Soil name and sample number | Horizon | Depth from surface | Particle size (3-A-1): Sand (2-0.05 mm) | Silt: Coarse (0.05-0.02 mm) | Silt: Fine (0.02-0.002 mm) | Clay (0.002 mm) | Organic matter | Mineral content | Fiber: Unrubbed | Fiber: Rubbed | Sodium pyrophosphate color 10YR— |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Inches* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | |
| Andry: S69La-23-2 | O21 | 14-7 | | | | | 43 | 53 | 39 | 17 | 6/4 |
| | O22 | 7-0 | | | | | 26 | 66 | 34 | 9 | 6/3 |
| | A11 | 0-5 | 1.7 | 26.7 | 42.0 | 29.6 | 8 | 93 | | | |
| | A12 | 5-11 | 1.6 | 29.1 | 41.1 | 23.2 | 2 | 98 | | | |
| | A3 | 11-20 | 1.3 | 25.0 | 37.7 | 36.0 | 1 | 99 | | | |
| | B21cag | 20-37 | 7.1 | 26.2 | 36.8 | 29.9 | <1 | 99+ | | | |
| | B22g | 37-51 | 3.3 | 28.6 | 42.4 | 25.7 | <1 | 99+ | | | |
| S69La-23-5 | O21 | 12-6 | | | | | 44 | 59 | 48 | 28 | 7/3 |
| | O22 | 6-0 | | | | | 53 | 48 | 42 | 18 | 6/3 |
| | A1 | 0-6 | 1.0 | 32.0 | 46.8 | 20.2 | 7 | 94 | | | |
| | B1tg | 6-13 | .8 | 33.1 | 45.6 | 20.5 | 1 | 99 | | | |
| | B21tg | 13-26 | .8 | 28.5 | 41.0 | 29.7 | 1 | 99 | | | |
| | B22tg | 26-33 | 1.4 | 27.3 | 38.5 | 32.8 | <1 | 99+ | | | |
| | B3g | 33-48 | 2.2 | 28.3 | 39.7 | 29.8 | <1 | 99+ | | | |
| Delcomb: S69La-23-6 | Oi | 0-3 | | | | | 43 | 61 | 41 | 19 | 7/3 |
| | Oe | 3-12 | | | | | 52 | 53 | 43 | 15 | 5/3 |
| | Oa1 | 12-23 | | | | | 59 | 35 | 45 | 9 | 5/2 |
| | Oa1 | 23-33 | | | | | 60 | 41 | 41 | 8 | 3/3 |
| | Oa2 | 33-39 | | | | | 30 | 60 | 42 | 9 | 5/3 |
| | IIA11g | 39-46 | .6 | 30.8 | 42.0 | 26.6 | 6 | 94 | | | |
| | IIA12g | 46-52 | .7 | 35.3 | 40.3 | 23.1 | 1 | 99 | | | |
| | IIC1g | 52-58 | .5 | 27.8 | 37.9 | 33.6 | 1 | 99 | | | |
| Lafitte: S69La-23-4 | Oe | 0-16 | | | | | 69 | 21 | 42 | 20 | 5/3 |
| | Oa1 | 16-30 | | | | | 47 | 53 | 32 | 1 | 5/3 |
| | Oa1 | 30-43 | | | | | 50 | 44 | 28 | 8 | 5/3 |
| | Oa1 | 43-53 | | | | | 58 | 38 | 47 | 4 | 7/2 |
| | Oa2 | 53-63 | | | | | 64 | 27 | 42 | 3 | 6/3 |
| | Oa3 | 63-90 | | | | | 53 | 47 | 30 | 2 | 4.5/3 |
| | Oa4 | 90-132 | | | | | | 36 | | | |
| | IICg | 132-138 | .3 | .9 | 0.0 | 89.8 | | | | | |
| Maurepas: S69La-23-3 | Oa1 | 0-12 | | | | | 71 | 18 | 53 | 2 | 6/4 |
| | Oa2 | 12-27 | | | | | 74 | 14 | 52 | 1 | 7/3 |
| | Oa3 | 27-36 | | | | | 79 | 11 | 52 | 2 | 6/3 |
| | Oa3 | 36-50 | | | | | 76 | 1 | 53 | 13 | 6/3 |
| | Oa4 | 50-102 | | | | | | 4 | 58 | 28 | 5/4 |
| | IICg | 102-108 | | | | | 18 | | | | |
| Memphis: S69La-23-11 | B21t | 4-18 | .4 | 32.4 | 42.1 | 25.1 | | | | | |
| | B22t | 32-46 | .5 | 35.5 | 44.2 | 19.8 | | | | | |
| | IIB3 | 75-91 | 16.2 | 31.8 | 32.4 | 19.0 | | | | | |

[1]Trace.

soil in Lafayette Parish (S70La-28-2). Clays in the two Andry pedons (S69La-23-2 and S69La-23-5) have moderate amounts of moderately well-ordered smectite much like the clay in a pedon of a Jeanerette soil in Lafayette Parish (S70La-28-1). Clays in Delcomb S69La-23-7, Lafitte S69La-23-4, and Maurepas S69La- [redacted]

The particle-size distribution and the kinds of clay minerals in mineral soil material suggest that a blanket of loess was deposited over southern Iberia Parish at a time in the past when the entire area was above sea level. The loess was exposed to weathering and soil formation long enough to move clay materials downward in the soil. Clays on well-drained sites were like Memphis soils. Soils on somewhat poorly drained sites were like Jeanerette soils.

Regional subsidence and a rise in sea level caused the area to be inundated. Saline marshes developed adjacent to the Gulf of Mexico. Freshwater marshes and swamps developed farther inland. As the region

*test data for selected* soils
in the column headings. The symbol < **means less than]**

| Bulk density (field state) (4A3a) | Water content (field state) (4B4) | Cation exchange capacity (5A6a) | Reaction in 0.01m $CaCl_2$ | WRD (4C1) 1/3-bar tension Undried | WRD (4C1) 15-bar tension Dried | C-value | COLE (4D1) | Residue At 1/3 bar Undried | Residue At 1/3 bar Dried | Residue Minimum (dry) | CEC/Clay (8D1) | C/N | Carbonate (6E1b) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *g/cc* | *Percent* | *Meq/100g* | *pH* | *Cm/cm* | *Cm/cm* | | | *Cm/cm* | *Cm/cm* | *Cm/cm* | *Meq/g* | | *Percent* |
| | 510.0 | | 6.4 | | | | | | | | | 17 | |
| | 270.0 | | 6.7 | | | | | | | | | 16 | |
| 0.67 | 105.0 | 28.3 | 6.6 | 0.46 | 0.23 | 1.89 | 0.26 | 1.05 | 0.66 | | 0.96 | 17 | |
| | 33.7 | 19.3 | 7.4 | | | .73 | | | | | .68 | 19 | |
| 1.25 | 42.4 | 27.5 | 7.3 | .19 | .18 | .77 | .047 | .92 | .91 | | .76 | 14 | |
| 1.40 | 32.5 | 20.4 | 7.2 | .24 | .22 | .79 | .092 | 1.01 | 1.02 | | .68 | | 9 |
| | 23.6 | 20.4 | 7.1 | | | .52 | | | | | .79 | | 2 |
| | 478.0 | | 6.6 | | | | | | | | | 18 | |
| | 576.0 | | 6.1 | | | | | | | .11 | | 16 | |
| | 63.4 | 21.1 | 6.5 | .28 | .23 | 1.31 | .19 | .98 | .94 | | 1.04 | 20 | |
| | 34.8 | 11.2 | 7.0 | .18 | .22 | .82 | .028 | .93 | .95 | | .55 | 20 | |
| | 39.0 | 13.2 | 6.6 | .21 | .18 | .77 | .037 | .87 | .90 | | .44 | | |
| | 39.0 | 13.5 | 6.6 | | | .72 | | | | | .41 | | |
| | 38.7 | 14.5 | 6.6 | | | .77 | | | | | .48 | | (1) |
| .17 | 432.0 | | 6.3 | .35 | | | | .94 | .40 | .07 | | 17 | |
| .13 | 560.0 | | 6.4 | .29 | | | | .93 | .32 | .04 | | 24 | |
| .10 | 858.0 | | 6.6 | .43 | | | | .63 | .15 | .02 | | 16 | |
| .12 | 733.0 | | 6.6 | .45 | | | | .71 | .23 | .04 | | 18 | |
| .19 | 613.0 | | 6.6 | .51 | .15 | | | .37 | .23 | .08 | | 17 | |
| | 84.2 | 21.5 | 6.7 | | | 1.54 | | | | | .81 | | |
| 1.17 | 41.1 | 14.7 | 7.4 | .20 | .24 | .98 | .025 | .87 | .87 | | .62 | | |
| 1.25 | 48.5 | 17.8 | 7.3 | .24 | .17 | .97 | .052 | .88 | .87 | | .53 | | |
| .09 | 817.0 | 77.9 | 6.1 | .28 | | | | .69 | | .02 | | 23 | |
| .10 | 856.0 | 85.6 | 6.7 | .35 | | | | .50 | .16 | .02 | | 18 | |
| .10 | 809.0 | 78.0 | 6.9 | .48 | | | | .45 | | .02 | | 19 | |
| .11 | 840.0 | 100.0 | 6.8 | .45 | | | | .69 | | .03 | | 16 | |
| .13 | 706.0 | 100.0 | 6.7 | .53 | | | | .40 | | .04 | | 18 | |
| | 633.0 | 87.4 | 6.8 | | | | | | | | | 19 | |
| | 625.0 | | | | | | | | | | | | |
| .12 | 686.0 | | 5.6 | .44 | | | | .57 | | .04 | | 32 | |
| .13 | 670.0 | | 6.1 | | | | | | | .04 | | 16 | |
| .08 | 817.0 | | 6.2 | .42 | | | | .50 | | .01 | | 21 | |
| | 810.0 | | 6.2 | | | | | | | | | 20 | |
| | 988.0 | | 6.6 | | | | | | | | | | |

continued to subside, however, saline marshes encroached into freshwater marshes and swamps. Tree stumps in present day saline marshes are evidence of saltwater encroachment. The buildup of organic soil keeps pace with landward encroachment of the marsh.

The principal source of salts in saline marshes is the Gulf of Mexico. Calcium is selectively removed by aquatic shell formers to make calcium carbonate shells. Sulfate is selectively reduced and removed in some layers by anaerobic bacteria that need the associated oxygen. As a result the salt composition in saline marshes does not reflect directly the composition of sea water. Exchangeable cations show a higher proportion of calcium because it is selectively absorbed by both organic and mineral soil material. Samples equilibrated in the laboratory to obtain soluble salts indicate higher levels of soluble calcium than apparently is true in the field. Concretions of calcium carbonate in Andry S69La-23-2 probably formed after the area became a marsh.

As a byproduct of sulfate reduction, sulfides are produced and may precipitate as iron sulfides. A buildup of sulfides may cause an acid sulfate soil once the

TABLE 9.—*Chemical test*

[Numbers for the various test methods are

| Soil name and sample number | Horizon | Depth from surface | Soluble cations (6A1) | | | | | Sodium-absorption ratio (5E) | Conductivity (8A1a) | Soluble anions (8A1) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ca (6N1b) | Mg (6O1b) | Na (6P1a) | K (6Q1a) | Sum | | | $HCO_3$ (6J1a) | Cl (6K1a) |
| | | *Inches* | *Meq/l* | *Meq/l* | *Meq/l* | *Meq/l* | *Meq/l* | | *Mmhos/cm* | *Meq/l* | *Meq/l* |
| Andry: S69La-23-2 | A11 | 0–5 | 19.3 | 26.3 | 56.5 | 1.1 | 103.2 | 12 | 9.38 | 0.0 | 54.2 |
| | A12 | 5-11 | 15.0 | 18.5 | 53.0 | .7 | 87.2 | 13 | 8.41 | .0 | 50.9 |
| | B22g | 37-51 | [1]8.5 | [2]7.5 | 44.5 | .2 | 60.7 | 16 | 6.51 | 1.3 | 52.3 |
| Delcomb: S69La-23-6 | IIA11g | 39–46 | 25.0 | 42.5 | 55.0 | 2.2 | 124.7 | 9 | 10.40 | .0 | 49.4 |
| | 11.1126 | 46–52 | 19.3 | 33.3 | 47.0 | 2.1 | 101.7 | 9 | 8.71 | .2 | 38.1 |
| Lafitte: S69La-23-4 | Oe | 0–16 | 3.1 | 9.0 | 40.0 | 1.6 | 53.7 | 16 | 5.80 | .9 | 4i.2 |
| | Oa1 | 16–30 | 8.5 | 26.0 | 70.0 | 1.9 | 106.4 | 17 | 10.40 | .4 | 81.i |
| | Oa2 | 30–43 | 11.0 | 36.3 | 89.0 | 2.1 | *138.4* | 18 | 13.00 | .2 | 106.3 |
| Maurepas: S69La-23-8 | Oa1 | 0–6 | 1.3 | 2.i | *21.b* | .9 | 26.4 | lb | 2.91 | 1.8 | 22.7 |
| | Oa5 | 37–48 | 3.8 | 13.5 | 29.0 | .9 | 49.2 | 9 | 4.88 | .4 | 2i.3 |

[1] Based on Investigations Method 6N4c.
[2] Bared on Investigations Method 6Q4c.
[3] Trace.

land is drained and oxidized.

***Characteristics of** drained organic **soils***

Organic soils form in an inundated environment **and** are stable in that environment. If the water is removed, and oxidizing conditions prevail, the organic material is no longer stable. The physical instability, apparent immediately as a loss of water buoyancy, results in consolidation of materials and subsidence of the **sur**face. The lower the content of resistant fibers, the greater the consolidation and initial subsidence. In Iberia Parish, subsidence is least in the marsh surface where the mat of live roots gives strength to the material. Laboratory indicators of initial subsidence suggest the residue of **organics will** be from 40 **to** 70 percent of the original volume for layers below the **sur**face and 70 to 90 percent in the surface, where samples become air-dry. If the upper **12** inches becomes air dry and the rest stays moist, with the water table maintained at 40 inches below the surface, shrinkage **upon** air drying (initial subsidence) would be 49 percent in Delcomb **S69La-89-6** and 63 percent in **Lafitte S69La-23-4.** Mineral sediments that have never dried undergo consolidation and subsidence when drained. Initial subsidence is less than for organic **material;** residue ranges from 70 to 85 percent of the **original** volume.

**After** initial subsidence, mineral soils stabilize. Or-

TABLE lo.-water ***test data***

[*Numbers for* **the various test methods are shown** in **parentheses** in **the** column **headings**]

| Soil name and sample number | Source of water sample | Soluble cations | | | | | Sodium-absorption ratio (5E) | Conductivity (8A1a) |
|---|---|---|---|---|---|---|---|---|
| | | Ca (6N1b) | Mg (6O1b) | Na (6P1a) | K (6Q1a) | Sum | | |
| | | *Meq/l* | *Meq/l* | *Meq/l* | *Meq/l* | *Meq/l* | | *Mmhos/cm* |
| Andry: | | | | | | | | |
| S69La-23-2 | Surface water | 1.0 | 5.5 | 37.5 | 0.7 | 44.7 | 21 | 4.74 |
| S69La-23-3 | Ground water | 1.6 | 6.2 | 35.5 | .5 | 43.8 | 18 | 4.72 |
| Delcomb: | | | | | | | | |
| S69La-23-6 | Ground water | .2 | 11.8 | 59.5 | .9 | 72.4 | 24 | 7.65 |
| S69La-23-7 | Ground water | 2.9 | 6.6 | 4i.1 | .7 | 57.3 | 22 | 6.05 |
| Lafitte: S69La-23-9 | Surface water | .1 | 6.8 | 33.4 | .5 | 40.8 | 18 | 4.29 |
| Maurepas: | | | | | | | | |
| S69La-23-3 | Ground water | .2 | 11.0 | 4i.I | .8 | 59.1 | 20 | 6.38 |
| S69La-23-5 | Ground water | .. | 3.4 | 23.0 | .3 | 26.7 | 18 | 3.12 |
| S69La-23-8 | Canal water | .4 | 6.0 | 132.0 | .8 | *139.2* | 74 | 14.30 |
| | Average seawater | 20 | 106 | 459 | 10 | 595 | 58 | 42 |

*data for selected soils*

shown in parentheses in the column headings]

| Soluble anions (8A1)—Cont. | | Resistivity (8A2) | Exchangeable cations (5B1b) | | | | | | | Exchangeable sodium (5D2) |
|---|---|---|---|---|---|---|---|---|---|---|
| $SO_4$ (6L1a) | Sum | | Ca (6N2e) | Mg (6O2d) | | K (6Q2a) | | | | |
| *Meq/l* | *Meq/l* | *Ohms* | *Meq/100g* | | | *Meq/100g* | *Meq/100g* | *Meq/100g* | *Percent* | *Percent* |
| 54.7 | 108.9 | 230 | 12.8 | | | 0.7 | 26.5 | 13.9 | 94 | 8 |
| 42.2 | 93.1 | 280 | 9.0 | | | .5 | 19.2 | 7.9 | 99 | 11 |
| 9.9 | 63.5 | 360 | 9.1 | | | .2 | 19.9 | | | 19 |
| 84.1 | 133.5 | 280 | | | | 1.0 | | | | 9 |
| 73.8 | 111.9 | 290 | | | | .7 | | | | 9 |
| 7.8 | 55.9 | 300 | | | | 1.3 | | | | 11 |
| 30.2 | 112.3 | 210 | | | | .8 | | | | 23 |
| 39.8 | 146.3 | 140 | | | | .3 | | | | 27 |
| .0 | 24.5 | 600 | | | | 1.9 | | | | 17 |
| 21.9 | 49.8 | 390 | | | | ([1]) | | | | 8 |

usually
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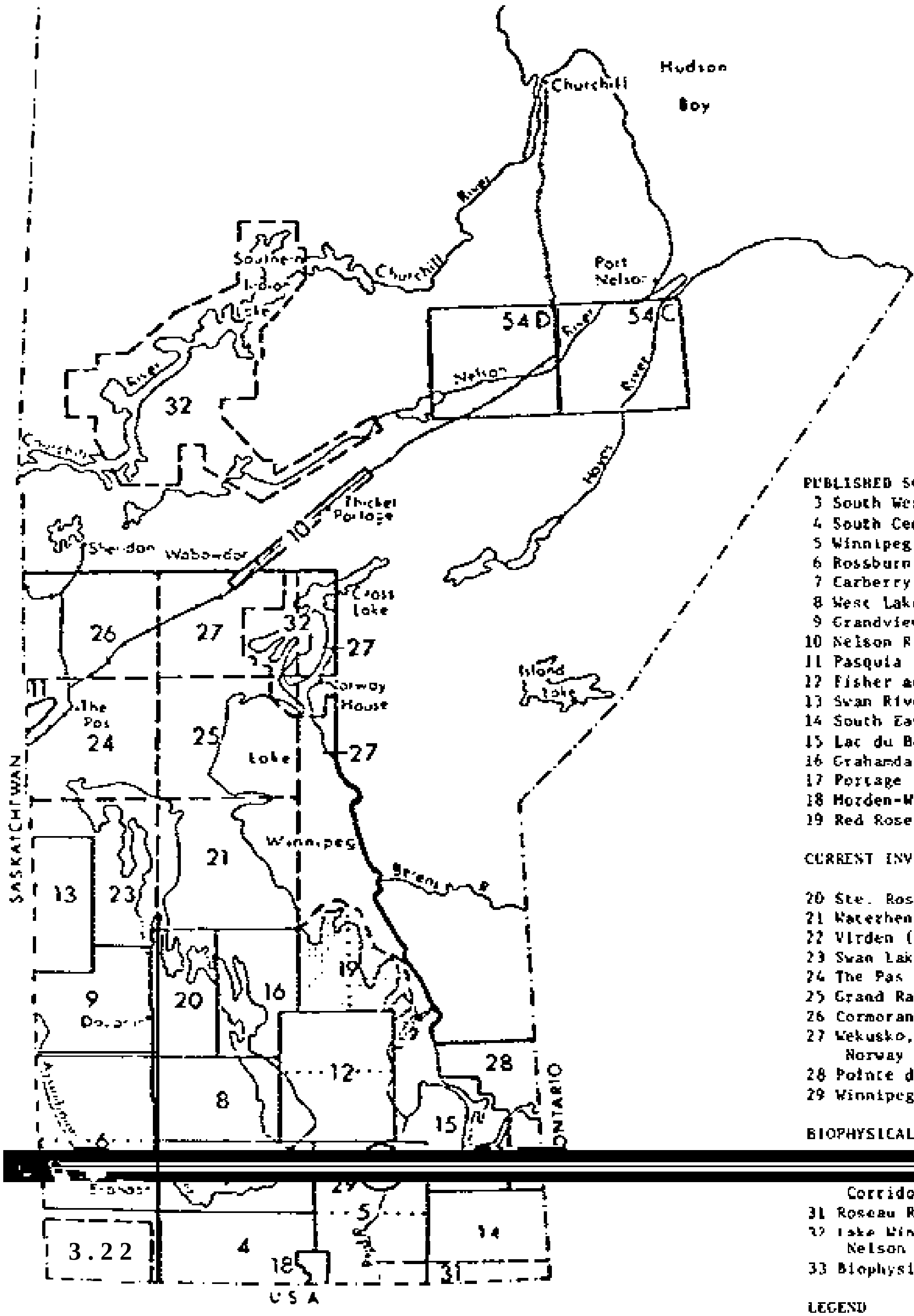
e

Committee 1: Use end Interpretation of Soil Survey Characterization Data

Appendix No. 2




PUBLISHED SOIL REPORTS

3 South Western
4 South Central
5 Winnipeg and Morris
6 Rossburn and Virden
7 Carberry
8 West Lake
9 Grandview
10 Nelson River Basin
11 Pasquia (Detail)
12 Fisher and Teulon
13 Swan River
14 South Eastern
15 Lac du Bonnet
16 Grahamdale
17 Portage la Prairie (Detail)
18 Morden-Winkler (Detail)
19 Red Rose-Washow Bay

CURRENT INVENTORY PROJECTS

20 Ste. Rose
21 Waterhen
22 Virden (Detail & Reconnaissance)
23 Swan Lake
24 The Pas
25 Grand Rapids
26 Cormorant Lake
27 Wekusko, Cross Lake and Norway House
28 Pointe du Bois
29 Winnipeg Region Study

BIOPHYSICAL STUDIES

Corridor N.W.T.
31 Roseau River Study
32 Lake Winnipeg, Churchill and Nelson Rivers Study
33 Biophysical Inventories

LEGEND

ARDA Boundary
Published Soil Reports
Current Inventory Projects

FIGURE I

Current Status of Soil Survey Mapping Projects in Manitoba

# SOILS

## of the

# RED ROSE — WASHOW BAY AREA

by

R.E. SMITH. C. TARNOCAI and G.F. MILLS

MANITOBA SOIL SURVEY

CANADA DEPARTMENT OF AGRICULTURE

MANITOBA DEPARTMENT OF AGRICULTURE

MANITOBA DEPARTMENT OF MINES.
RESOURCES AND ENVIRONMENTAL MANAGEMENT

and

DEPARTMENT OF SOIL SCIENCE,
THE UNIVERSITY OF MANITOBA

*Report published by the Manitoba Department of Agriculture*
*Map published by the Canada Department of Agriculture*

FIGURE 34

Section through the surface layer of fibric Sphagnum moss peat. Note the stunted 15 to 20 year old black spruce tree. The rapidly growing Sphagnum has covered over the lower branches of this tree.

derlying coarse to moderately coarse textured, sandy lacustrine sediments are usually moderately calcareous, grade from mildly to moderately alkaline in reaction, are iron stained and stone-free.

The Caldon Series, a Sphagno-Fibrisol. This soils is developed on deep, usually more than 5 feet thick, extremely acid, uniform deposits of pale brown, fibric Sphagnum moss peat. This surface layer of Sphagnum is usually underlain by a variable depth of woody, very dark brown mesic forest or fen par. Very often. both types will occur in the soil profile. The total depth of the organic section of this soil ranges from about 3 to 12 feet in thickness.

The Erskine Series, a Typic Mesisol, Sphagnic phase. This soil is similar in profile characteristics to the Sproule Series. The major difference is that the fibric Sphagnum surface layer of the Erskine soils is thinner. ranging from 2 to 3 feet. than that of the Sproule Series. Otherwise, total depth of the organic section and the characteristics of the mesic subsurface organic layers and mineral substrate are the same as those of the Sproule Series

These soils are very similar to those described under the Julius complex. but differ from them in having a coarse acd moderately coarse substrate rather than a medium to fine textured lacustrine substrate. The topography is depressional to level and the native vegetation is dominantly stunted black spruce and tamarack with an understory of Sphagnum mosses and ericaceous shrubs.

### Mapping Unit

Sproule complex (1,377 acres)

These areas consist dominantly of Sproule series with significant amounts of Caldon series Minor amounts of Erskine soils also occur.

## ST. LABRE SERIES

The St. Labre series are well drained Orthic Grey Luvisol soils developed on 6 to 30 inches of weakly to moderately calcareous sand underlain by medium textured, very stony. extremely calcareous glacial till. These soils occur on gently undulating to undulating topography. Native vegetation is dominantly aspen. jack pine. and birch. A representative porfile is described below:

L-H —1 to

TABLE 45

Analysis of St. Labre Fine Sand

| Hor. | Depth Inches | Mechanical Analysis: Text. Class | % Sand | % Silt | % Clay | % Moisture 1/3 Atm | pH | Cond. mmhos/cm | % $CaCO_3$ Equiv. | % Org. C | % Total N | C/N Ratio | $NaHCO_3$ Extr. P ppm | C.E.C.* me | Exchangeable Cations* me/100 gms: Ca | Mg | K | Na | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L-H | 1-0 | – | – | – | – | 69.0 | 5.7 | – | – | 33.0 | 1.3 | 25 | [illegible] | – | – | – | – | – | – |
| Ae1 | 0-2 | FS | 95 | 3 | 2 | 3.2 | 5.5 | – | – | 0.7 | 0.02 | 35 | [illegible] | 3.6 | 2.1 | 0.6 | 0.1 | 0.1 | 2.3 |
| Ae2 | 2-17 | FS | 95 | 3 | 2 | 2.2 | 6.6 | – | – | 0.1 | 0.01 | 10 | [illegible] | [illegible] | 1.4 | 0.9 | 0.1 | 0.1 | 4.0 |
| AB | 17-26 | FS | 94 | 2 | 4 | 3.5 | 6.7 | – | – | 0.1 | 0.01 | 10 | [illegible] | 2.6 | 1.5 | 1.1 | 0.1 | 0.1 | 1.6 |
| Bt | 26-28 | LFS | 87 | 6 | 7 | 6.4 | 7.5 | 0.4 | 3.1 | 0.3 | 0.03 | 10 | [illegible] | [illegible] | 5.3 | 1.0 | 0.2 | 0.1 | – |
| IIC | 28-36 | L | 37 | 38 | 25 | 16.9 | 7.6 | 0.3 | 43.3 | 0.2 | – | – | [illegible] | [illegible] | 7.6 | 3.1 | 0.2 | 0.1 | – |

*C.E.C. and exchangeable cations determined by using 1:1 ethanol to neutral in ammonium acetate

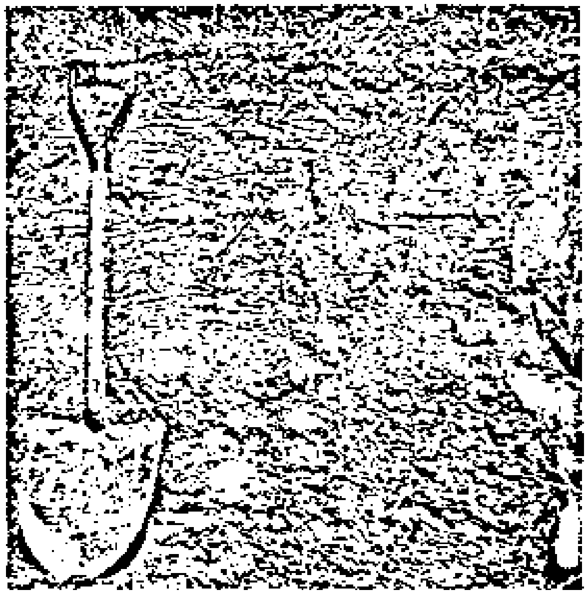


**FIGURE 35**

St. Labre sand. An Orthic Grey Luvisol developed on a thin mantle of sand underlain by stony glacial till.

Ae1 — 0 to 2 inches, light grey (10YR 7/2 dry) fine sand; loose; strongly acid; clear, smooth boundary.

Ae2 — 2 to 17 inches, very pale brown (10YR 7/3, dry), fine sand, loose, slightly acid; clear, wavy boundary.

AB — 17 to 26 inches, light yellowish brown (10YR 6/4, dry) fine sand, weak, fine granular, very friable when moist, soft when dry; neutral, abrupt, smooth boundary.

Bt — 26 to 28 inches, dark yellowish brown (10YR 5/4 to 6/4, dry) gravelly loamy fine sand: weak, medium subangular blocky; friable when moist, soft to slightly hard when dry; mildly alkaline: abrupt, smooth boundary.

IIC — 28 to 36 inches, light brownish grey (2.5Y 6/2, dry), loam, strong, fine blocky-like structure, firm when moist, hard to somewhat cemented when dry; moderately alkaline and extremely calcareous.

St. Labre soils have a thick, light grey togrey Ae horizon within the sand overlay and a thin, moderately developed, textural B horizon in the finer textured substrate. The C horizon usually consists of light grey, very stony, extremely calcareous loam to clay loam textured till.

### *Mapping Units*

St. Labre series (4,331 acres)

These areas consist dominantly of St. Labre series with minor areas of Pine Ridge series.

## STEADCOMPLEX

The Stead complex consists of very poorly drained organic soils developed on greater than 52 inches of m&c fen (herbaceous) peat. Little (less than 24 inches) or no sphagnum peat occurs as a surface layer on these soils. These soils are underlain by medium to fine textured, moderately to strongly calcareous, lacustrine sediments.

The Stead Complex consists of the following Series:

The Stead Series, a Typic Mesisol. This soil is developed on greater than 52 inches of mesic or moderately decomposed, very dark brown. medium acid, non-woody, very uniform fen peat (moderately decomposed peat derived mainly fmm sedges, reed grasses, brown mosses and other herbaceous plants). Occasionally. these soils may have a very thin, discontinuous fibric Sphagnum surface layer. The total depth of the organic section normally ranges from about 5 to 10 feet. The underlying, greyish colored lacustrine clay sediments are usually very strongly calcareous and moderately alkaline in reaction A representative profile of the Stead Series is described below:

of — 0 to 12 inches, very dark brown (10YR 2/2, moist), fine, non-woody fibrous, with about 74 percent fiber content; neutral; dominantly sedge and significant amounts of mosses.

Om — 12 to 59 inches, brow (7.5YR 4/2, moist) to very dark brown (10YR 2/2, moist) medium fibered: moderately decomposed; matted to felt-like: medium acid; herbaceous material: about 54 percent (near top) to 32 percent (near bottom) fiber content

**TABLE 46**

Analysis of Stead Series (Typic Mesisol)

| Hor. | Depth Inches | Mechanical Analysis: Text Class | % Sand | % Silt | % Clay | % Unrubbed Fiber | Pyrophos Sol. | % Ash | % Org C | % Total N | C/N Ratio | pH in CaCl2 | C.E.C. me | Exchangeable Cations me/100 gms: Ca | Mg | K | Na | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Of | 0-12 | — | — | — | — | 74.6 | 0.11 | 8.8 | 50.05 | 2.07 | 29 | 6.30 | 113.4 | 60.6 | 38.5 | 1.1 | 1.0 | [illegible] |
| Om1 | 12-20 | — | — | — | — | 54.2 | 0.76 | 10.2 | — | — | — | — | 132.2 | 80.9 | 46.8 | 1.5 | 0.3 | [illegible] |
| Om2 | 20-40 | — | — | — | — | 53.1 | 0.34 | 14.6 | 55.56 | 3.22 | 17 | 5.75 | 128.2 | 80.0 | 43.5 | 1.2 | 0.3 | [illegible] |
| Om3 | 40-59 | — | — | — | — | 37.5 | 0.50 | 33.0 | 41.53 | 2.41 | 17 | 5.75 | 116.3 | 68.5 | 35.5 | 1.1 | 0.4 | - |
| Oh | 59-71 | — | — | — | — | 20.6 | 0.15 | 56.4 | — | — | — | 7.2 | 78.1 | 51.3 | 26.3 | 0.8 | 0.4 | [illegible] |
| [illegible] | 71-75 | SiCL | 1 | 65 | 34 | — | — | 89.3 | — | — | — | 7.25 | — | — | — | — | — | — |
| IICg | 75+ | SiCL | 3 | 61 | 36 | — | — | 96.5 | — | — | — | 7.25 | — | — | — | — | — | — |

| | | |
|---|---|---|
| Oh | – | 59 to 71 inches, very dark brown to black (10YR 2/2 to 2/1, moist), amorphous granular, matted to felt-like, medium acid, herbaceous material, about 20 percent fiber |
| IIAhg | – | 71 to 75 inches, black (5Y 2/1, wet), clay, massive, breaking to fine granular, sticky and very plastic when wet, mildly alkaline |
| IICg | – | 75 inches plus, light grey, (5Y 2/1, wet), clay, massive, sticky and very plastic, mildly alkaline |

These organic soils usually have a very dark brown, fibrous, sufrace layer. This grades into a thick, medium fibered, matted, mesic layer. A thin, well decomposed, black humic layer is also present. These soils are medium acid to neutral in reaction (see Figure 11).

The Jackhead Series, a Limno Mesisol. This soil is developed on 5 to 10 feet of dominantly, very dark brown non-woody, mesic fen peat. They have alternating, subdominant layers of whitish colored, marl (composed of precipitated and biologically deposited calcium carbonate) with mesic fen peat layers below a thin (8 to 10 inches thick) layer of fibric fen peat. Occasionally, a thin (less than 12 inches) marl layer occurs at the surface of these soils.

*Mapping Unit*

Stead complex (101,849 acres)

These areas consist dominantly of Stead series with minor amounts of Jackhead and Kitimik series.

## SUNDOWN SERIES

The Sundown series consists of poorly drained, Rego Humic Gleysol soils developed on moderately to strongly calcareous, stratified sand and gravel outwash and beach deposits. These soils occupy level to depressional areas bordering gravelly beach ridges. Runoff is very slow and internal drainage is impeded by a high ground water table. Native vegetation is black and white spruce, tamarack and sedges.

The Sundown soils have a thin (6 to 16 inches) layer of mesic fen peat. This peaty surface layer rests on a thin, dark grey, calcareous Ahg horizon. The Ahg horizon is developed in a thin, finer textured mantle and is underlain by a strongly calcareous and strongly iron stained, light grey, stratified, sandy and gravelly Cg horizon.

*Mapping Units*

Sundown peaty phase (4,806 acres)

These areas consist dominantly of Sundown soils having 6 to 16 inches of mesic fen peat and minor inclusions of Rat River and Sand River complexes.

## TARNO SERIES

The Tarno series are poorly drained, Rego Humic Gleysol soils developed on a thin (6 to 30 inches) lacustrine clay over strongly calcareous silty sediments. These soils occur in depressional to level clay plain areas. Surface runoff is very slow and internal drainage is also slow. The native vegetation is dominantly sedges and meadow grasses with scattered groves of of black spruce, willow and balsam poplar. A representative profile of the Tarno peaty phase is described below.

| | | |
|---|---|---|
| L-H1 | – | 16 to 8 inches, dark olive (5Y 3/3, moist) coarse fibered sedge peat, medium acid, clear, smooth boundary |
| L-H2 | – | 8 to 0 inches, dark olive (5Y 3/3 moist) moderately decomposed sedge peat, strongly acid, abrupt smooth boundary |
| Ahg | – | 0 to 3 inches, dark olive grey (5Y 3/2 moist) clay to clay loam, moderate medium granular, firm when moist, very hard when dry, neutral, iron concretions, abrupt, smooth boundary |
| ACg | – | 3 to 6 inches, very dark grey (5Y 3/1, moist) clay, moderate medium granular, firm when moist, very hard when dry, mildly alkaline, iron and calcium carbonate concretions, clear, smooth boundary |
| IICg | – | 6 inches plus, olive grey (5Y 5/2, moist) sandy loam to clay loam, friable when moist, very hard when dry, mildly alkaline, iron and calcium carbonate concretions |

Tarno soils have a thin surface layer of fibrous to moderately decomposed sedge peat, underlain by a thin, granular Ahg horizon. The Ahg horizon

TABLE 47

Analysis of Tarno Clay Loam

| Hor. | Depth inches | Text. Class | % Sand | % Silt | % Clay | pH | Cond. mmhos/cm | % $CaCO_3$ Equiv. | % Ca [illegible] | % [illegible] | % Org. C | % N [illegible] | C/N Ratio | Soluble Salts: Ca | Mg | Na | Cl | $SO_4$ | Total Ca | Total [illegible] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L-H1 | 16-8 | — | – | – | – | 5.75 | 4.06 | — | — | — | 50.38 | 2.50 | [illegible] | 15.2 | 49.6 | 3.7 | — | 63.4 | [illegible] | [illegible] |
| L-H2 | 8-0 | — | — | — | — | 5.34 | 4.77 | — | — | — | [illegible] | 2.56 | [illegible] | 19.9 | 44.2 | 6.3 | — | 67.4 | [illegible] | [illegible] |
| Ahg | 0-3 | C | [illegible] | 35 | 39 | 6.95 | 5.85 | [illegible] | [illegible] | 12.24 | 4.35 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | - | [illegible] | [illegible] | [illegible] |
| ACg | 3-6 | C | [illegible] | 37 | 42 | 7.55 | 2.50 | 27.11 | 2.37 | 13.32 | — | — | — | 12.3 | 15.3 | 3.8 | - | 29.4 | 31.4 | [illegible] |
| IICg | 6+ | C | 44 | 27 | 29 | 7.76 | 1.36 | 35.61 | 6.31 | 25.0 | — | — | — | [illegible] | — | — | - | — | — | — |

Committee II - Soil Variability and Quality Soil Surveys

Chairman: Charles M. Thompson

Vice-Chairman: Jimmie W. Frie

Members: Benny Brashear * | David Lietzke | Don Philen*
C. Elkins * | Ted Miller* | L. P. Wilding
Harlan Finney" | J. H. Newton

I. Original charges to the committee

A. Establish guidelines for determining

1. Kinds of information needed for major landscapes

2. Scale of mapping

3. Kinds of mapping units

4. Maximum efficient method of mapping the landscape

B. Test and make recommendations for refining "Hajek-Steers Method" of making transects.

II. The committee has combined some of the original charges and they are restated as follows:

A. Identify the constraints to Quality Control in field observations.

B. Develop example methods of writing or illustrating to users the:

1. Composition of mapping units

2. Variability of mapping units

3. Displaying confidence limits of soils and soil interpretations

As a prelude to developing the ideas, the committee discussed the need for field soil scientist to have a useful understanding of several sampling schemes. As a part of this report we are including a paper by Dr. Wilding that presents a discussion of (1) Random sampling, (2) Transect sampling, (3) Grid sampling.

*Not present at conference

Random sampling is used primarily in areas where the landscapes are essentially featureless. The Hajek-Steers Method 'is used mainly where the landscape has observable features and the transects are stratified so as to represent the mapping unit. Grid sampling, when tied to elevations is a useful tool in preparing three-dimensional perspectives of soil characteristics.

III. A partial list of constraints to quality control in field observations is as follows:

A. Training soil scientists

1. Soil-Geomorphic relationships (where do we make observations)

2. Soil morphology

3. Generalization in mapping procedures (Ability of the soil scientist to make intelligent decisions in routine mapping)

B. Use of appropriate sampling methods to determine composition and variability. Close-interval variability.

C. Additional time required. Changing existing mapping scale in the survey area.

D. Correct identification of the central concept of the mapping unit and the range of the mapping unit.

E. Accurate placing of soil boundary lines on the map.

F. Quality base imagery

1. Photo interpretation on imagery

2. Accurately locating yourself on aerial photo

G. Definition of mapping unit. Design of mapping unit.

H. Clear objective of the soil survey for a specific survey area.

I. Verification of the mapping unit (May tie to the use of the most appropriate sampling technique.)

The committee recommends that these constraints (and possibly others) be expanded and developed to a point that party leaders can recognize the need of the soil survey party to address the problems early in the survey. This committee report should provide part of the materials that would be helpful to party leaders.

IV. Relaying information of mapping units and interpretations as to composition and variability to users.

There are at least two basic questions:

1. How do we record variability?

2. How do we convey this to the user?

We are speaking primarily to question 2 in this report.

We have identified at least five methods of conveying variability of soils and soil interpretations to users. Attached are specific examples that will illustrate the methods.

| METHODS | EXAMPLES |
|---|---|
| 1. Tabular form | Paper by Dr. Lietzke, B. Brashear suggestion to place additional information at the end of m.u. in tabular form. |
| 2. Narrative | Texas example of single and multi-taxa unit, using binomial statistical evaluation of field data. In addition B. Brashear's tabular form will be included as an example. |
| 3. Cross-Section form | Conventional hand drawn. |
| 4. Block diagram | Computer net in 3-dimension. |
| 5. Photographic form | i.e., picture of variability in Lufkin series. soil survey of Brazos County, Texas |

When using the narrative form we may need to convey to the users how the included soils occur in the landscape. In other words, how do the minor inclusions that have somewhat different behavior occur with the named soil or component soils.

Block diagrams or computer net 3-dimensional diagrams can demonstrate how variability occurs as related to the relief, either of the surface or some diagnostic subsurface horizon or event.

Ii variability is not consistently related to relief, we might wish to use the tabular or narrative forms.

V. Conclusion

A. That each state should have the responsibility of control on the designing of mapping units as well as flexibility in describing to users the variability of mapping units, both from the point of view of the soils as well as their interpretations. We would hope that we would continue to explore better ways of handling information. We must not operate totally under the constraints of present methods, procedures and computer programs.

VI. Recommendation

A. It is recommended that the committee be continued.

# SAMPLING SCHEMES

1.. P. Wilding
Professor
Department of Soil and Crop Science
Texas A&El University
College station, Texas

Unpublished--draft of partial text
of Soil Genesis and Classification

The difference between a pedologist using statistics and a statistician without soils experience is that a pedologist should have a much better concept of soil property relationships and how soil distribution patterns covary with landscape features. With such prior knowledge care must be Exercised not to confound systematic and random variability in design of the sampling scheme. For example, if soils systematically change as a function of relief, then the most efficient sampling scheme will be one that traverses drainage systems at right angles. Likewise, sampling wit hin a pedon, either laterally or vertically, should not be at random. No useful purpose is gained in compositing soil materials of known morphological, physical, chemical or mineralogical difference. Random sampling is suitable only when soil differences are not evident.

Space does not permit a comprehensive appraisal of sampling schemes that could be used in soil variability investigations. Perhaps the major consideration revolves about the kinds of questions to be answered, the object

## Random Sampling

Random point sampling has been employed to determine soil compositional aspects of mapping unit delineations (Wilding, et al., 1965) and to evaluate the utility of specific class criteria as operational differentiae (McCormack and Wilding, 1969). It has also been commonly employed as a means to withdraw subsample replicates in analytical analysis. Random sampling schemes are unbiased, statistically sound and commonly preferred by statisticians. They have the disadvantage that the density of observations per unit area and the dispersion of the sites over the delineation are not uniform. For example, the possibility exists that all of the observations will be in a cluster at the boundary of the class. In addition, if systematic variation does exist, it will likely be unidentified.

For determing mapping unit composition specific delineations and sites within delineations can be draw" at random from potential delineations screened for areal extent, slope, erosion, cultural features or other basis to stratify the sample. Sites are located in the office on aerial photographs or field sheets so that actual field conditions do not bias the choice of sample sites. A suitable-sized grid with numbered squares is superposed on the unit and sampling points chosen from a random numbers table. All sites (not just those that fit a particular concept) are observed and recorded.

Characterization of intra-class central tendency and dispersion statistics of a" established taxonomic unit (i.e., soil seires) can be accomplished similar to above methods but most recognize that boundary limits are pre-set (Knox, 1965); no sampling scheme will provide information about fiducial limits or ranges for differentiating characteristics because these are defined by the series concept. However, such statistics can be gained on "accidental" or noncovarying properties within the class. When determining the intra-class composition of soils reflecting a given concept, observations can be draw" at random within landscape segments or mapping unit delineations but sufficient alternate sites must be provided to accommodate observations clearly outside the series range.

I" contrast, if one is establishing a series concept defined in terms of central tendencies of the nucleous and variability about such a mode (Cline, 1944), then boundary limits are not pre-set and differences in class concepts can be statistically differentiated on the basis of central tendency and variance statistics; the confidence limits of differentiae can likewise be formulated from this data.

Sometimes valuable information concerning the distribution intra-class composition can be obtained through a comprehensive soil characterization program similar to the one which has been active in Ohio since 1952. Sampling is not restricted to profiles that represent only modal series concepts but rather encompass (and sometimes exceed) the series range. Such data can be screened so only those individuals within current series concepts are included in statistical summaries (Wilding, et al., 1964). Although it is recognized that the requirements of random sampling are not strictly satisfied, they are approximated as a result of: (a) the scope of the sampling program as discussed above, (b) the wide geographical scattering of sampling sites within the state, (c) the relatively long-time spa" during which sampling occurred and (d) the selection of sampling sites by numerous soil scientists.

## Transect Sampling

Point-intercept and line-intercept transect sampling techniques have been widely employed for determining mapping unit composition (Powell and Springer, 1965) and in petrographic analyses (Brewer, 1976, p. 50). The line-intercept method is quicker when an observer can visually recognize each kind of class as it passes through a boundary. More commonly, the point-intercept method is used in studying soil-landscape patterns because differentiae demarcating soil boundaries are not readily observable. Transect methods depend on the principle that the total length of a given class along straight line segments is directly proportional to the area of the class within the limits of the larger area transected. The line-transect method has been criticized because the number of observations necessary for reliable mean estimates are impractically high (White, 1966). Transect sampling, however, can take advantage of various trenches, powerlines, or highway excavations which frequently have been pre-aligned independent of soil bias. It has also been used to advantage in remote regions to construct reconnaissance soil surveys where mobility or other restrictions make conventional procedures impractical.

The question of preferred versus random transect orientation and the observational interval often arises. Where systematic changes in soil patterns follow landscape features, then transects should be oriented normal to such changes for greatest efficiency and maximum extrapolation of results. Conversely, where landscape features are not apparent (i.e., nearly level, featureless plains) or where vegetation obliterates such features then random transects are in order. Transects may be oriented parallel to one another with observational intervals adjusted to form a grid pattern or they may take the form of a cross to yield three dimensional control (Fig. 6 ). The observational interval should be dictated by the nature and complexity of the spatial variation. When preliminary sampling indicates close-interval complexity, then the magnitude of variability that could be expected in a pedon is first identified ;once pedon variability is established, then the observational interval can be extended such that reoccurrence of similar conditions is sufficiently frequent that landscape functions, systematic relationships and random error can be partitioned. Initial observations will be at intervals of a meter or less and increase progressively to IO'S of meters or more. It is often argued that the spacing of observations is independent of statistical probability but this ignores practical implications of close-interval variation and considerations set forth above. Under given conditions, maximum efficiency may result from intensive sampling of a short segment of a given transect at the expense of multiple transects. Before the question of transect numbers can bc answered, close-interval spatial variation must first be documented.

## Grid Sampling

In many studies, the grid sampling scheme is preferred because of equally spaced observations and because it is better suited for certain statistical and computer plotting applications (Hock, et al., 1973). Likewise, this scheme is better adapted to geomorphic-pedogenic interpretations. With elevation control at each sampling site, it is possible to construct the three-dimensional surface of limiting zones, diagnostic horizons, stratigraphic and geomorphic units. It provides the optimum in three-dimensional control with the flexibility to examine a cross-sectional segment at any reference point of interest. Systematic variation as a function of topography is most readily deduced from this design.

ABSTRACT

# USE OF MAPPING UNIT VARIABILITY AS A CRITERION IN MAKING INTERPRETATIONS AND DEVELOPING MAP UNIT POTENTIALS FOR MULTIPLE USES[1]

BY

D. A. LIETZKE, R. S. WEBER, AND D. F. AMOS[2]

Mapping units are more or less variable in the range of soil properties contained. This variability is due to geologic complexity, geomorphic complexity, interaction of soil forming factors, map scale, design of napping units, and cartographic constraints. Since the map unit is the basic unit that is used in planning, interpretations should be based on the range of soil properties, and the complexity of the soil pattern within the mapping unit. It is important to predict response or the potential for some intended use for that mapping unit. If this can be done the user of soil survey will be more informed of the range of those properties in the map unit that are of importance for any proposed use.

The use of a variability factor as a criterion in rating mapping units for potential uses will alert the user to what can be expected if a more intensive on-site evaluation must be made, or the number of soils within the map unit could be reduced in number by a 1st order soil survey. The following is proposed:

Degree

## USE OF MAPPING UNIT VARIABILITY AS A CRITERION IN MAKING INTERPRETATIONS

Too many users of soil surveys have the concept that a mapping unit is all what the name says it is.

This concept is especially true for many non-agricultural users, e.g., planners and sanitarians who conclude that the map is no good if a hole they dig does not correspond to the name.

As a result soil surveys have a credibility problem among many users. Why?

1. Soil surveys used for purposes for which they were not intended.
2. Variability of mapping units not recognized or not accounted for in naming of mapping units, or in the writing of mapping unit descriptions, or in charts detailing various interpretations.
3. Soil Scientists who mapped did not "see" the finer scale variabilityoftheir mapping units due to production goals or other constraints. That is, the field soil scientist sees the gross variability, which is part of the mapping procedure, e.g., the ability to predict ahead. In this regard the field soil scientist can dig biased holes, especially if his conceptual model of soil-landscape patterns and relationships is flawed.

The purpose of this study was to intensively investigate the composition of some mapping units, determine the kinds of variability and to propose an additional mapping unit variable to be rated when making interpretations so that the user is made aware of the variability of mapping unit properties for any use that is under consideration.

## LITERATURE REVIEW

Mader (4) working on a forest soil-site study in the northeast on glacial tills and outwash showed that "some soil properties required a large number of samples for accurate estimation, others of small number." Nader was concerned with the number of samples that needed to be analyzed from any one plot in order to have a representative analysis of the soil properties.

McCormack and Wilding (5) in a study of stratified soils derived from glacial materials found that the most variable properties were: depth to mottling, depth to fine textured discontinuity, horizon thickness, texture and chroma of the B2t horizon, percent of mottles having chroma of 2 or less, and grade of structure. They concluded that the average transect made by a soil scientist during the mapping of a medium intensity (2nd order) survey did not provide enough information about the proportions of variability in the pattern of soils within mapping units. The McCormack and Wilding study was primarily concerned with soil properties important for classification and the number of observations needed to estimate the range of properties within a given limit of accuracy.

Even though there was low agreement with the mapping unit name, few mapping units were considered to be improperly mapped. The problem was in the proper naming of the mapping units in reflecting the variability of soils.

Amos and Whiteside (1) studied mapping unit composition in a rather complex glacial till-outwash area of central Michigan. They used four contrast value classes to arrive at some means of defining just what contrasting soils were.

0 - No Contrast - soils of the same series

1 - Low Contrast - soils of close resemblence

2 - Medium Contrast - soils of some resemblence

3 - High Contrast - soils of little resemblence

The soils common to their study area were assigned a contrast number in comparison to the soil being studied. Thus a soil could have all degrees of contrast depending on what other soil it was compared with.

Amos and h'hiteside concluded that most of the mapping units should be renamed as complexes in the area they studied, and that a more accurate reflection of the soil variability, as revealed in the mapping unit name, should result in surveys more useable for interpretive purposes.

Janson and Arnold (3) describe two major types of mapping unit inclusions. The first consisting of soilscapes that can be recognized and their position in the landscape known, but cannot be delineated due to cartographic constraints. The second type of inclusion consists of variability which is a consequence of geology and geomorphology interacting with soil forming factors. This type of variability cannot easily be predicted in the landscape nor is the range in properties always known or controlled.

Cline (2) states that "we still have to acknowledge the differences between taxonomic soil series and those mapping units that bear the same name and will probably have to rectify the confusion this causes."

Since most lay users have the concept of a mapping unit as being an entity composed of the soil named, a serious credibility problem has arisen, especially among non-agricultural users. If a hole is dug in a mapping unit and does not correspond with the soil named, the conclusion is reached that the map is not good.

Therefore, pedologists must understand how soil maps are used by the layman, especially those with urban and other more intensive uses of soil in mind, and then write mapping unit descriptions and name mapping units to reflect the whole composition of the mapping unit, and develop mapping unit interpretations in addition to specific interpretations for each major soil component within the map unit.

Soil Taxonomy provides a system such that every boring, backhoe pit exposure, etc. can be adequately and properly classified. The major problem ahead is conceptually defining map units. quantifying their physical - on the land - composition, name them so that their complexity or lack of complexity is represented or reflected in the name, and the development of map unit Interpretations or potentials for multiple use.

## RESULTS

Results of intensive studies of mapping units in the Coastal Plain, Piedmont and Appalachian Mountain areas of Virginia indicate that most mapping units are variable. Intensive investigations for more intensive uses further substantiates that most mapping units are complex. In the Coastal Plain most complexity is due to the stratified nature of the parent materials. In stratified soils, there are many discontinuities, especially in C horizons. This variable is not often considered extremely important for agricultural production and management, but is extremely important in evaluating soils for the placement of septic tank drainfields. Not only is the vertical stratification highly significant but even more so is the horizontal variability of soils on the Coastal Plain. Horizontal variability is much less readily seen and rarely can be predicted.

and Lietzke (8,9), Figures l-5.

All 23 are separated either by Soil Taxonomy Criteria (7) or by Interpretive Criteria (6). Eight of these component soils comprise about 60 percent of the mapping unit. The spatial variability in the Chester loam and silt loam mapping unit was evaluated by random oriented 200 foot grid transects. An additional grid at a 50 'foot interval around one randomly selected point revealed still additional variability could not be mapped even at a scale of 60 cm/cm (50 feet/inch). Weber et al (9) have also determined the physical, chemical and mineralogical properties of the 8 major units in the Chester study, which further documents the highly variable nature of the geologic parent materials and the soils that formed from them.

The Ridge and Valley Province of the Appalachian Mountains is characterized by steeply dipping folded and faulted rocks which results in an extremely complex soil pattern. A line transect, Figure 6, of one mapping unit perpendicular to the strike of the Rome formation in Montgomery County, Virginia, largely composed of shales with thin limestone and sandstone strata, showed the lack of rock in a mapping unit where depth to rock in the existing map unit description was stated to average less than 18 inches and range from 6 to 36 inches. In addition, the existing map unit description stated that the soils had little or no subsoil (argillic horizon) and only a substratum (C horizon). The transect showed that 50% of the observations had an argillic horizon and are deep to rock, and only 40% were shallow to rock and lacked an asgillic horizon.

Carbonate rocks that are steeply dipping or intermixed carbonate rocks and shales are even more variable. Figure 7 shows a transect in this geologic material. Studies elsewhere in glacial geology (1, 4, 5) illustrate chat moraines are highly variable in a complex pattern that cannot be easily predicted.

## DISCUSSION

Pedologists must abandon the concept that a mapping unit comprises one or two significant soils plus a few inclusions. What is significant for purposes of Soil Taxonomy or the central taxonomic concept of a mapping unit may not be highly significant at all when the properties of deeper soil horizons are considered.

Rather than this long standing philosophy, mapping units in reality are groups of component soils with a set of properties that range from non-significant to highly significant depending on the proposed use. Therefore, we propose a concept of a mapping unit as a physical geographic entity that separates one landscape segment from another. Some of these mapping units contain little variability while others are highly variable. Within each mapping unit there are a variable number of component soils, each with a distinct set of properties.

Soil series names or phases of soil series names should not be placed on a mapping unit since a series name represents a taxonomic concept. Each mapping unit should be identified only by some abstract designation, e.g. numbers or letters. This is especially true in re-correlation of existing map units where the older series concept was more broadly defined. Changing series names on map units with correlations or re-correlations causes confusion among the lay users and leads to credibility problems. Soil series names can be put on the significant component soils, changed by re-correlation without changing map unit headings. This technical pedology information can be put in an appendix for reference purposes. Each significant component soil of a mapping unit can be identified, classified and given a series name, and specific interpretation material prepared.

At the same time pedologists must make interpretations or determine use potentials of the whole mapping unit, not of the one major soil series in a consociation or the two or three major soils in a complex or association. Field soil scientists cannot map "real" consociations at any scale even 50 feet to the inch. There may be some places where it can be done. It is extremely difficult to find a uniform field plot in the southeastern United States because of the complex geology and geomorphology of the area interacting with soil forming processes.

However, if the policy makers of the National Cooperative Soil Survey do not elect to go to mapping unit interpretations, then a variability rating needs to be introduced in to the interpretations criteria for rating mapping units for various uses. The observed range in all soil properties for each mapping unit, plus the variability in numbers of component soils and the complexity in pattern must be used to develop mapping unit descriptions and interpretations It is extremely important to alert the lay user, who is not aware of series ranges in characteristics, use of taxadjuncts, variants, phases, "dashes", "ands", "similiar soils", and other ways pedologists have in naming mapping units, of the actual variability of soils in the physical entity of the mapping unit.

First order soil surveys of areas to be intensively used will result in the delineation of most obvious soilscapes that could not be delineated in a second order soil survey. However, even a first order soil survey will not be able to delineate variable soils resulting from geologic and geomorphic complexity interacting with soil forming processes which are not readily observed from the surface.

If future second order surveys are made at a scale of 1:24000 then many mapping units will tend to become more variable. The introduction ofavariability factor in any rating criteria becomes even *ore important.

The definition of a significantly different variable is based on Soil Taxonomy and the Guide for Interpreting Engineering Uses of Soils.

Any range in a soil property that exceeds the allowable family range in Soil Taxonomy or considered are rated where they have a significant effect on the use of a soil.

What is proposed is a variability factor that will be rated for any interpretation regardless of how a mapping unit is named.

An index of purity can be used to evaluate existing soil survey mapping units when a soil survey is updated.

## CONCLUSIONS

If a map unit has low variability let's inform the user of that fact. If a map unit has high variability and low predictability, let's inform the user of this too.

Alerting the soil survey user that napping units are more or less variable will reduce the present credibility problem. A moderate or severe limitation due to variability or lack of predictability will alert the user that a more detailed evaluation of the map unit or any individual delineation is needed, especially for those Site-specific interpretations listed on the SCS-Form 5.

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of soil properties among major components of the Chester loam and silt loam (CZC) mapping unit in Loudoun County. American Society of Agronomy Abstracts, Madison, Wisconsin.

## LIST OF TABLES


Table 1 Proposed addition to criteria for rating mapping units

Table 2 Proposed mapping unit rating scheme


## LIST OF FIGURES


Figure 1 Lithologic units comprising the basement complex in the core of the Blue Ridge Anticlinorium in northern and central Loudoun County, Virginia. This roadcut on Route 668, 1/2 mile north of Taylorstown, Virginia shows cataclastically deformed granodiorite gneiss inter-bedded with metabasites and mafic schists. The meta-basites are thought to represent sheared feeder dikes related to the Catoctin Formation. The repetition of lithologic units results in complex pedologic features associated with the Chester Loam-Chester Silt Loam Complex described as derived from acidic and mafic granodiorite. Roadcut Is about 13 meters in height and 40 meters in width.

Figure 2 Parent material variability in a Chester Loam and Silt Loam mapping unit. Blocks represent a soil boring in center of each block on 61 m centers. Both mafic shcists and felsic gneisses have been further subdivided based on composition and grain size.

Figure 3 Depthtoperched water as measured in piezometers in-stalled at 85 and 160 cm. The shallow wells measure the effect of the solum and the deep wells show the lowering effect of the less clayey subsoil.

Figure 4 Percolation rates at 75 and 157 cm in soils of a Chester Loam and Silt Loam mapping unit in Loudoun County, Virginia. The data emphasizes the greater rates in the more permeable saprolites as compared with subsoil.

Figure 5 Spatial distribution of taxonomic individuals in a Chester Loam and Silt Loam mapping unit in central Loudoun County, Virginia. Boreholes in the center of each block are spaced at 60 m. Microtraverse is spaced at 15 m.

Figure 6 Line transect across c "38C" map unit delineation in Montgomery County Virginia. The delineation is underlain by the Rome geoligic formation which consist of reddish, greenishand grayish calcareous shales, siltstones and sandstones, and some limestone. The formation is highly folded and faulted. Soil borings deeper than 25 inches all had argillic horizons. Soils less than 25inchesto rock had

Table 1. PROPOSED ADDITION TO CRITERIA FOR RATING MAPPING UNITS

| DEGREE OF LIMITATION | COMPONENT SOIL VARIABILITY | MAPPING UNIT USE PREDICTABILITY |
|---|---|---|
| SLIGHT | LOW TO MEDIUM | GOOD - Any component soils with significant differences are readily related to observable soilscape features (simple landscape). |
| MODERATE | MEDIUM TO HIGH | FAIR - Component soils are in complex landscapes but can still be related to observable soilscape features. |
| SEVERE | HIGH TO VERY HIGH | POOR - Number of component soils and complexity of patter is very high or soils cannot be related to easily observable soilscape features |

Table 2. MAPPING UNIT VARIABILITY RATING SCHEME

| RATING | VARIABILITY | INDEX OF PURITY | PREDICTABILITY |
|---|---|---|---|
| LOW | 1 to 2 Major Soil Components | >85 | HIGH |
| MEDIUM | 2 to 4 | 75-85 | MEDIUM |
| HIGH | 4 to 6 | 50-75 | LOW |
| VERY HIGH | More than 6 | >50 | VERY LOW |

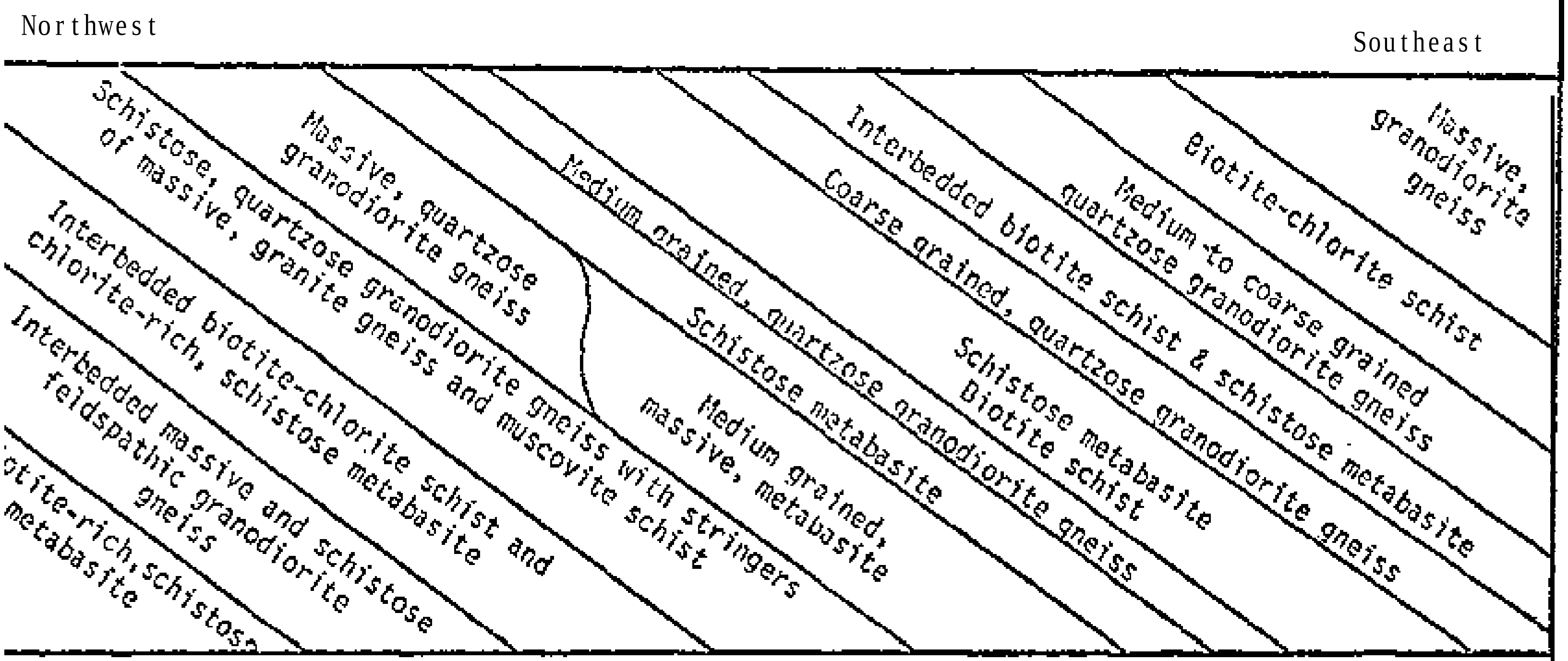



Figure 1: Lithologic units comprising the basement complex in the core of the Blue Ridge Anticlinorium in northern and central Loudoun County, Virginia. This roadcut on Route 668, 1/2 mile north of Taylorstown, Virginia shows cataclastically deformed granodioritc gneiss interbedded with metabasitcs and mafic schists. The metabasitcs are-thought to represent sheared feeder dikes related to the Catoctin Formation. The repetition of lithologic units results in complex pedologic features associated with the Chester Loam-Chester Silt Loam Complex described as derived from acidic and mafic granodiorite. Roadcut is about 13 meters in height and 40 meters in width.

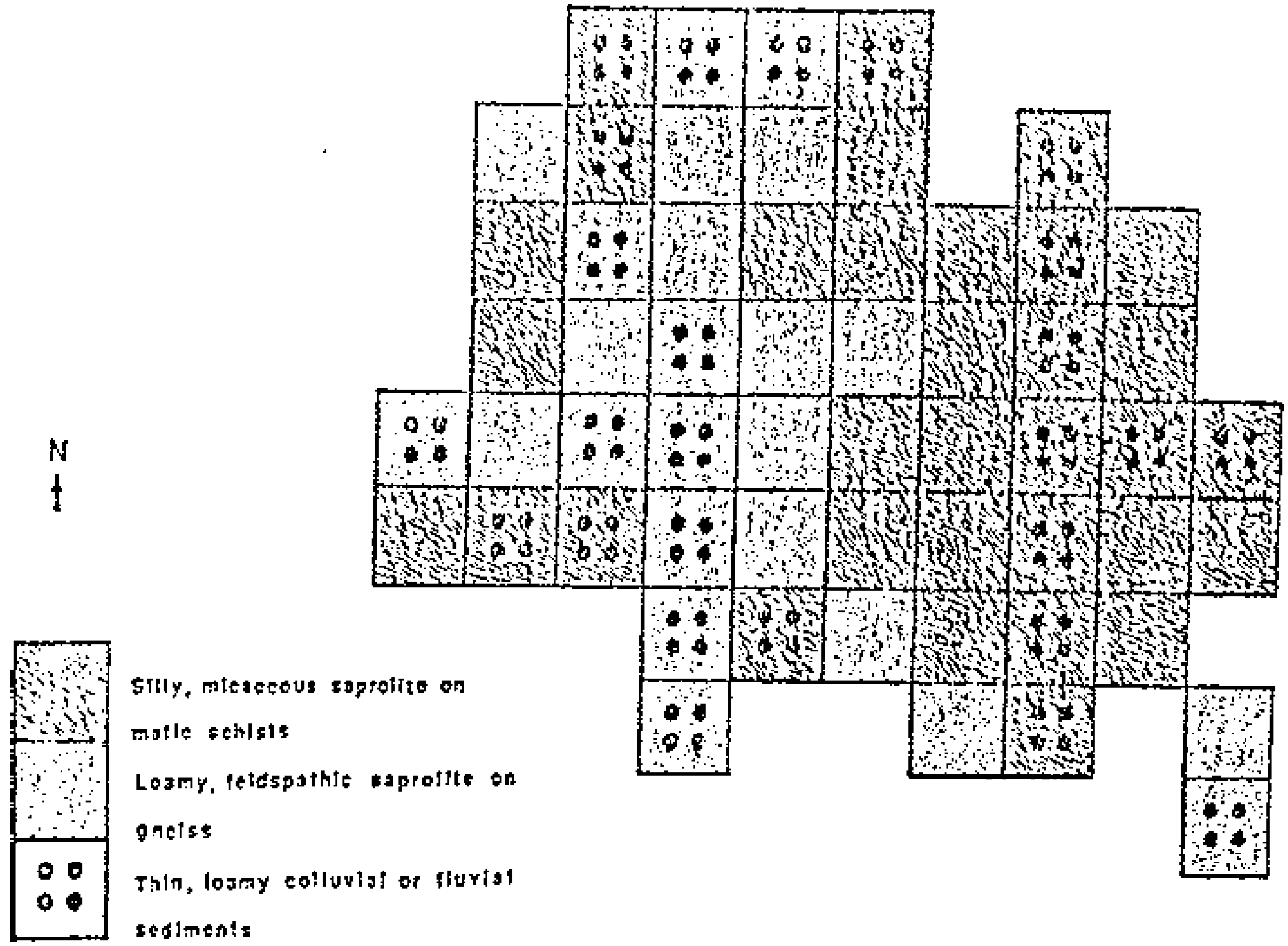



Figure 2: Parent material variability in a Chester Loam and Silt Loam mapping unit. Blocks represent a soil boring in center of each block on 61 m centers. Both mafic schists and felsic gneisses have been further subdivided based on composition and grain size.

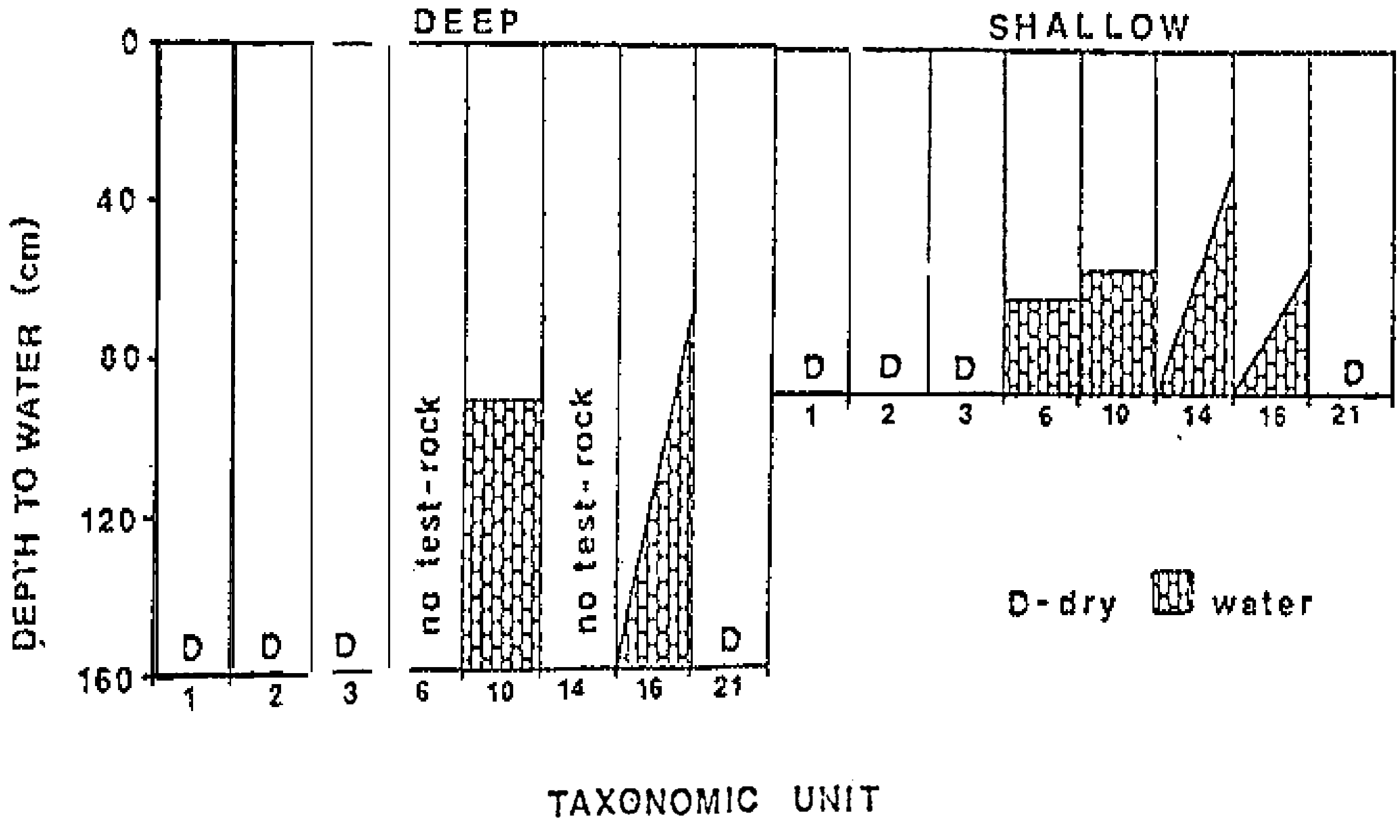
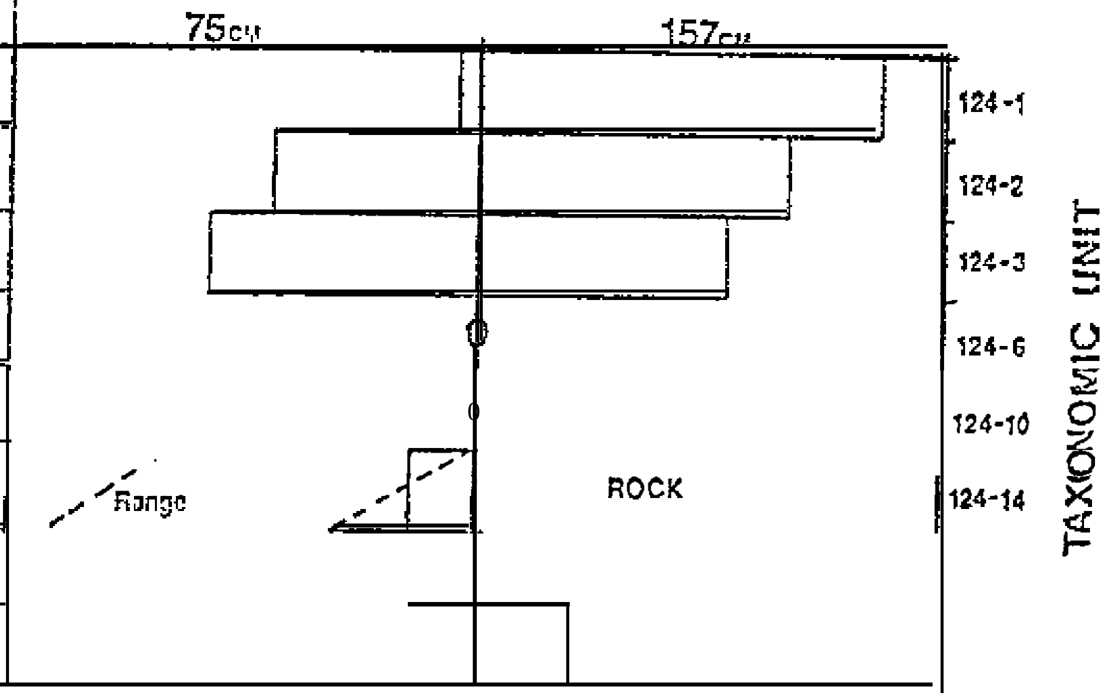



Figure 3: Depth to perched water as measured in piezometers installed at 85 and 160 cm. The shallow wells measure the effect of the solum and the deep wells show the lowering effect of the less clayey subsoil.

| PEDON NOTES |
|---|
| Moderate-structured, Fine-silty soils over micaceous, Silty saprolites |
| Strong-structured, clayey, soils over silty saprolites plugged with thin red clay films |
| Coarse-loamy, thin soils over massive coarse-grained saprolites |
| Plastic clay subsoil with perched watertable, over Cr horizon |
| Compact, loamy soils with perched watertable over compact saprolites |
| Shallow soils with brown schist Cr horizons at ~50 cm |

DEPTH OF TEST



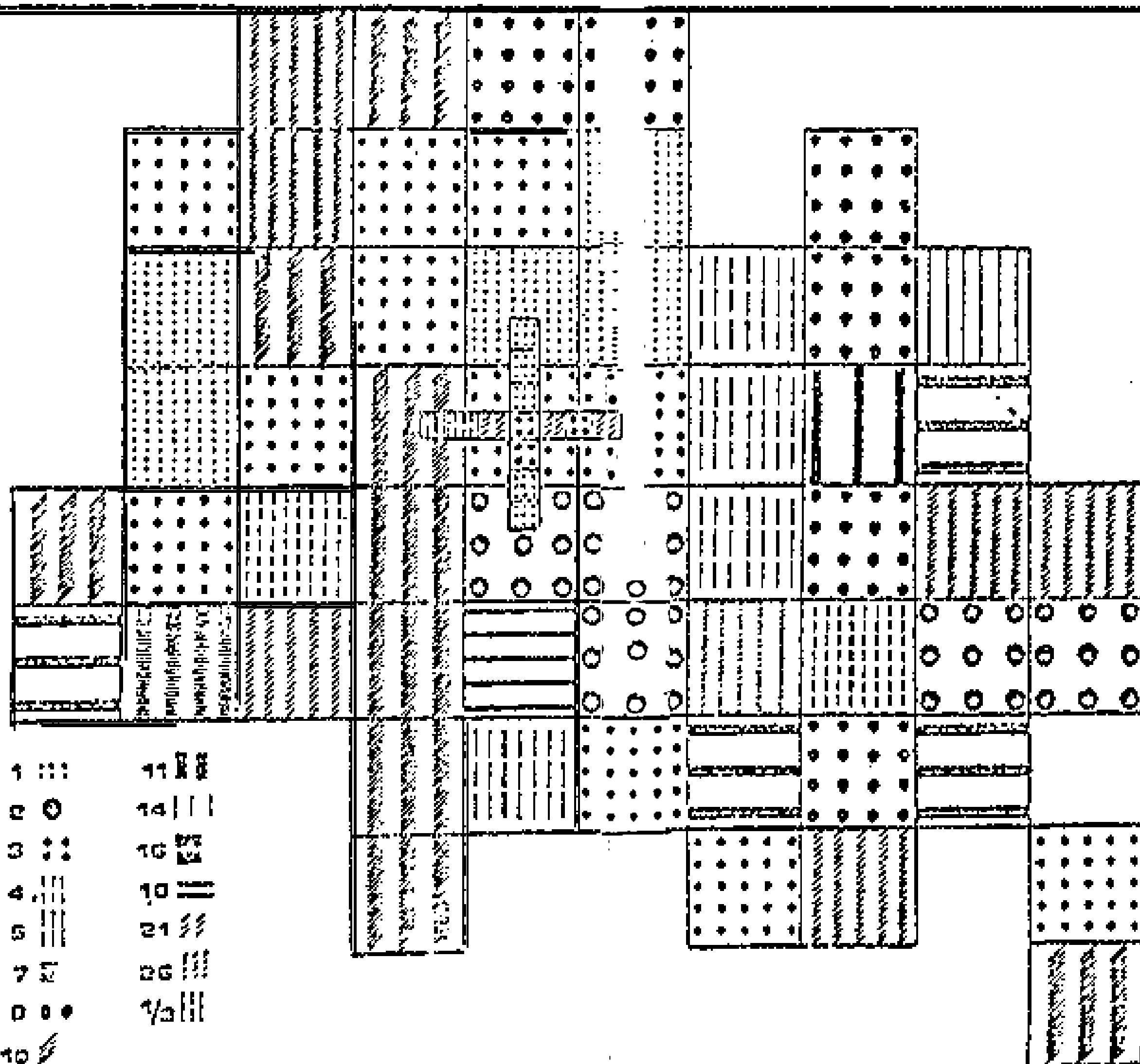
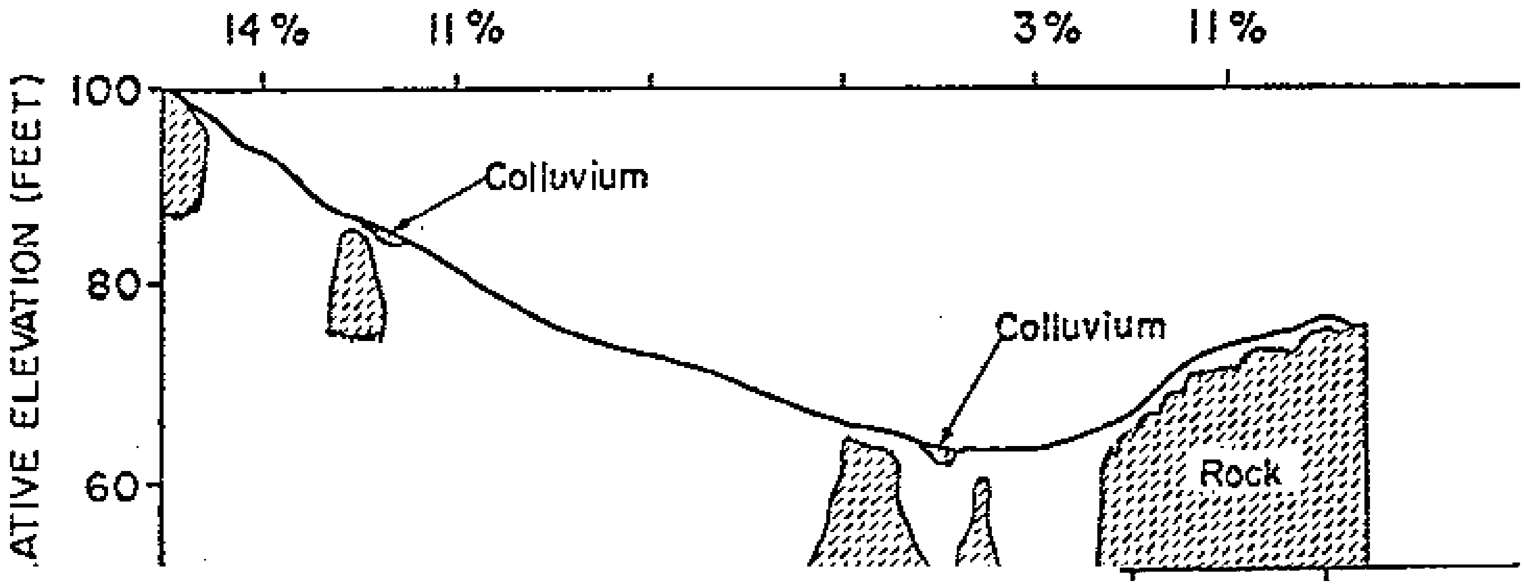
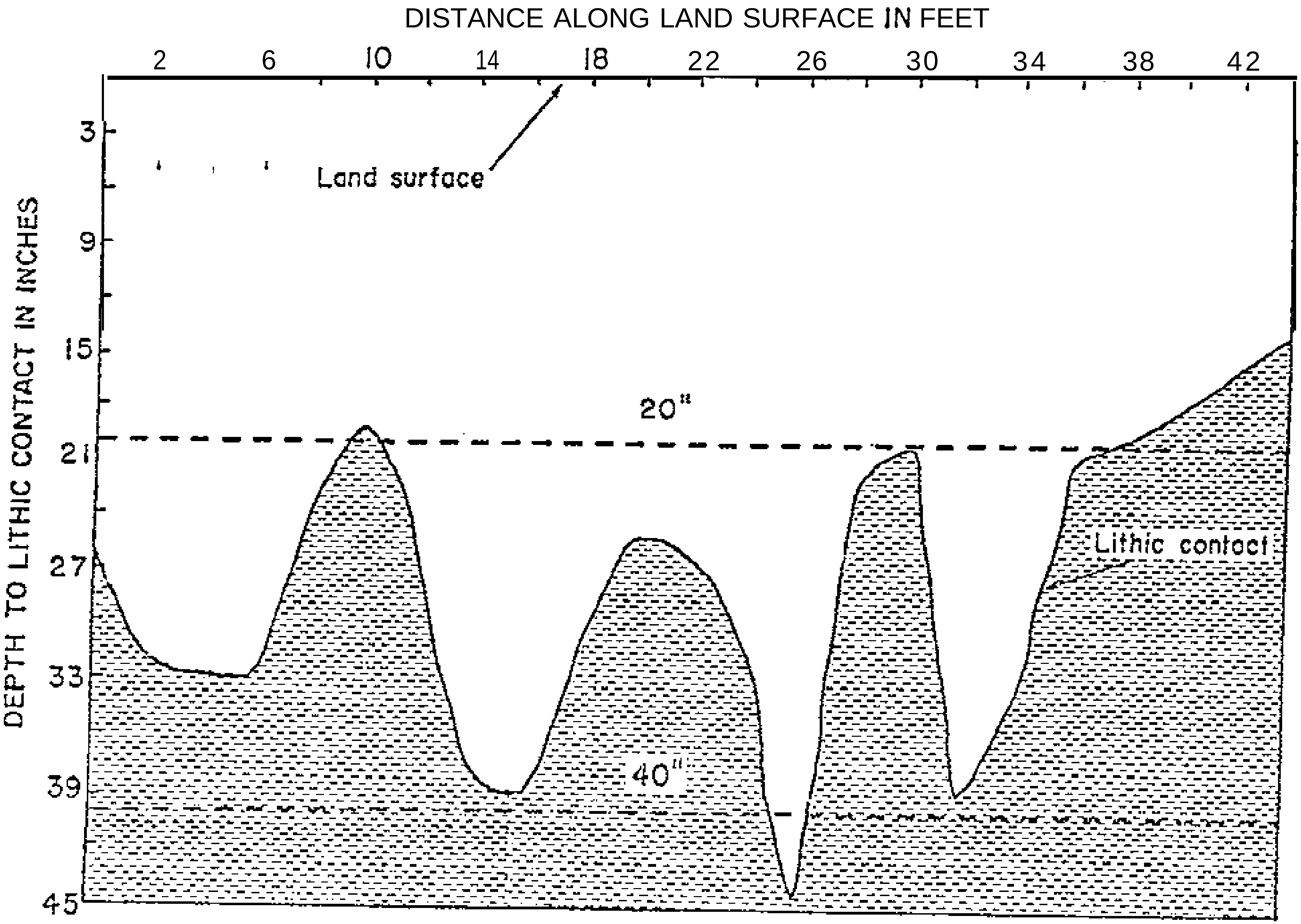



Figure 5: Spatial distribution of taxonomic individuals in a Chester Loam and Silt Loam mapping unit in central Loudoun County, Virginia. Boreholes in the center of each block are spaced at 60 m. Microtraverse is spaced at 15 m.


14%
11%
3%
11%
ATIVE ELEVATION (FEET)
100
80
60
Colluvium
Colluvium
Rock




Parent Material: Wayncsboro formation-interbedded shale, limestone, and dolomite with lenses and stringers of sondstone.

EXAMPLE
Single Taxa Mapping Unit

38--Denton silty clay, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on low ridges and concave side slopes. Areas are irregular in shape and range in size from 10 to 500 acres.

Typically, the surface layer is dark grayish brown silty clay about 6 inches deep. Below this is brown silty clay to 34 inches. From 34 to 38 inches is a mixture of flaggy limestone and brown silty clay. The underlying layer below 38 inches is fractured limestone interbedded with calcareous clayey marl.

The soil has medium available water capacity and slow permeability. It is well drained and has medium surface runoff.

Denton soils make up 82 to 90 percent of most mapped areas. In up to 20 percent of the areas the percentages vary from these ranges. The other soils in this unit are small areas of Crawford, Purves, San Saba, Slide11 and small areas of Denton soils that have slopes greater than 3 percent.

This soil is used mainly as cropland. Some areas are used as pastureland or rangeland.

Denton soils have a fair suitability for cropland. Grain sorghum, wheat, and oats are the main crops. A cropping system that helps control erosion and conserve moisture is needed. Terraces, grassed waterways, and contour tillage are needed in many areas where row crops are grown. Crop residue left on the surface improves tilth and helps control erosion.

This soil has a fair suitability for improved pasture grasses. Adapted grasses include bermudagrasses, kleingrass and clovergrasses.

The main range plants in a climax community are little bluestem, indiangrass, sideoats grama, big bluestem with a few native legumes and forbs. Proper management practices, including controlled grazing and proper stocking, are needed to get the best grass production.

'Wildlife habitat potential is good. The main species are dove, bobwhite, quail, and rabbits.

The soil has a fair suitability for most urban and recreational uses. The main limiting features are shrinking and swelling with changes in soil moisture, low strength affecting roads and streets, high corrosivity to steel, and moderate depth to rock. These features affect the design of foundations, roads, and septic tank filter fields. The main limitations for recreational uses are high clay content and slow permeability. Capability subclass IIe; Clay Loam range site.

EXAMPLE

Alternate Inclusion and Composition Statements

#1

Included with this soil in mapping are small areas of San Saba, Crawford. Purves, and Slide11 soils as well as small areas of Denton soils with slopes greater than 3 percent. In most areas mapped as this unit, the included soils make up 12 to 17 percent of the unit. In up to 20 percent of the areas mapped as Denton, the percentage of inclusions may fall outside this range.

#2

Included with Denton in mapping of this unit are small areas of San Saba, Crawford, Purves, and Slide11 soils as well as areas of Denton soils that have short slopes that are greater than 3 percent. In a typical map unit, Denton soils make up 86 percent of the unit but range from 82 to 90 percent of the unit. However, there is the possibility that the percentage of Denton soils will be more or less than the range given in up to 20 percent of the areas mapped as Denton.

#3

Included with this soil in mapping are areas of San Saba, Crawford, Purves, and Slide11 soils as well as areas of Denton soils that have short slopes that are greater than 3 percent. In 80 percent of more of the areas mapped as Denton, the included soils range from 12 to 17 percent of the unit. In the remainder of the areas, the percentage of inclusions may be

#4

#5

#6

EXAMPLE
Multi-taxa Mapping Unit

601--Doss-Real complex, 1 to 8 percent slopes. These are shallow, gently sloping to sloping soils on plane to convex side slopes and ridge tops. The areas are irregular in shape and range from 25 to 500 acres. These soils are so intricately mixed that they cannot be shown separately at the scale of mapping used.

In most areas, Doss clay loam makes up 46 percent of the map unit; Real gravelly clay loam makes up 20 to 38 percent; and other soils make up 8 to 26 percent. The other soils are small areas of Bolar and Eckrant that are intermingled with the Doss and Real soils, and long, narrow areas of Krum and Lewisville soils along some of the small drains that dissect this complex. In up to 20 percent of the mapped areas the percentages vary from the ranges given.

Typically, the Doss soil is brown, moderately alkaline clay loam to about 12 inches. The underlying layer is light gray, weakly cemented, marly limestone. Most of the Doss soils are 11 to 13 inches deep. Limestone fragments make up 4 to 10 percent of the surface layer and 4 to 14 percent of the subsoil. Up to 5 percent of the Doss soils may have depths and amounts of fragments that differ from these.

Doss soils are well drained and have medium runoff. Permeability is moderately slow, and available water capabity is low.

Typically, Real soils are dark grayish brown, moderately alkaline very gravelly clay loam to about 11 inches. Below this is white, weakly cemented limestone. These soils are 9 to 13 inches thick and limestone fragments range from 13 to 29 percent in the upper part of the soil and 42 to 54 percent in the lower part. In up to 5 percent of the Real soils encountered the depth to rock or amount of fragments may differ from these.

Real soils are well drained and have rapid surface runoff. Permeability is moderate, and available water capacity is very low.

This complex is used mostly for rangeland and wildlife habitat and is generally not used for cropland because of depth to rock and limestone fragments.

The climax plant community in rangeland is a mixture of little bluestem, big bluestem, indiangrass, sideoats grama, and other perennial grasses and forbs. However, in many areas, the vegetation at present is a mixture of little bluestem, sideoats grama, and threeawns with an overstory of cedar and a severe weed problem because of prolonged overgrazing. Proper stocking rates, controlled grazing, and weed control are the major management practices needed. Deer, turkey, rabbit, and dove are the main wildlife species.

This soil complex is poorly suited for pasture grasses such as coastal bermudagrass. Limestone fragments hinder establishment of the grasses, and low available water capacity limits growth.

The main limitations for urban and recreational use are depth to rock and the amount of limestone fragments. They especially affect septic tank filter fields, lawns, and gardens. However, some areas that have native trees and wild flowers make scenic home sites. Capability subclass VIs; Shallow range site.

Table ________, Inclusions in mapping units ........ 1/

| <--Mapping Unit--> | | <---------------------------Inclusions--------------------------------> | | | | | |
|---|---|---|---|---|---|---|---|
| | | Kind or Series Name | Identifying Feature | | | | |
| Map Symbol | Capability Class | | Landscape Position | Other | Capability Class | Pct of Mapping unit | Effect on Use & Mgt. of Mapping unit |

1/ See mapping unit description.

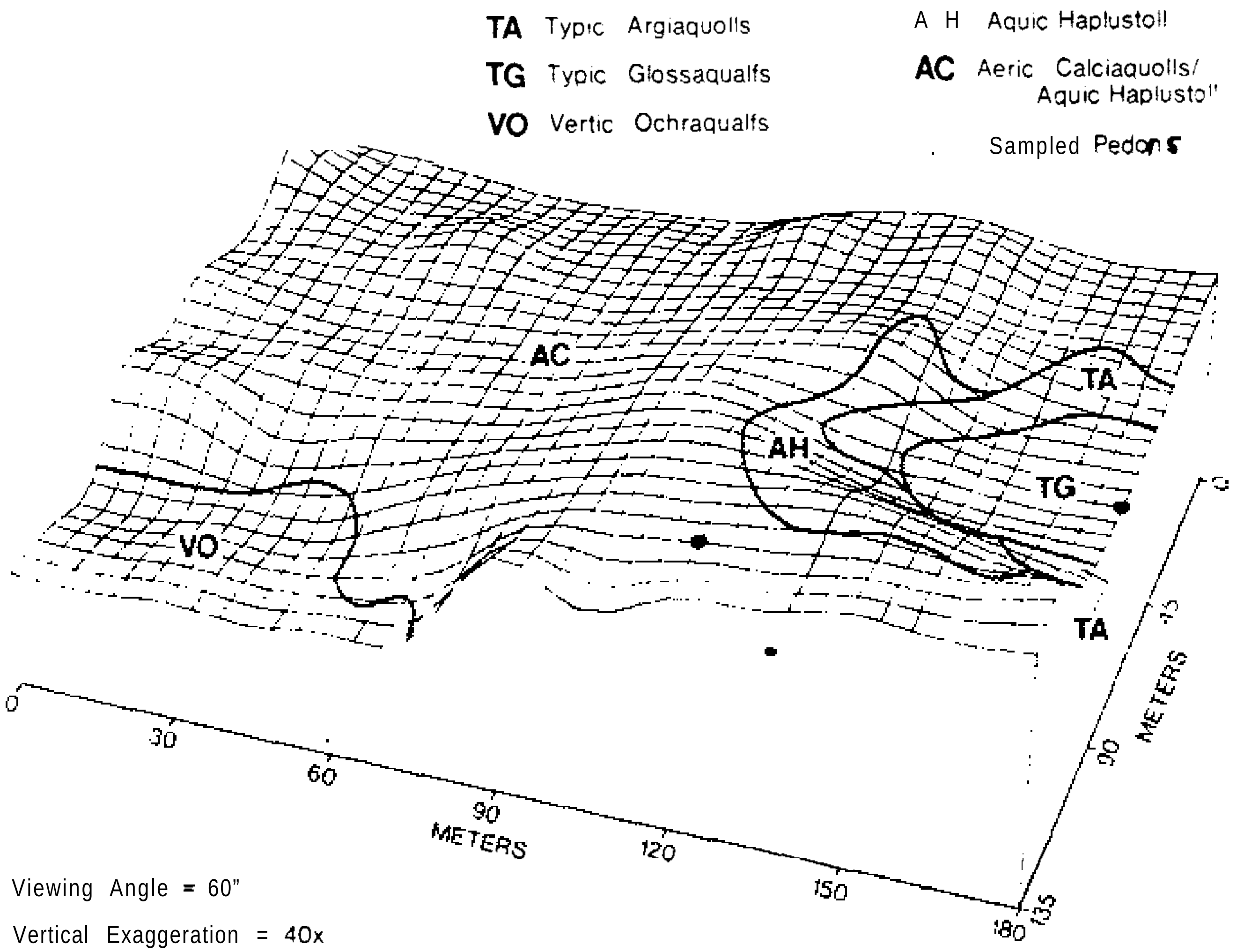



Fig. 6--Soils map superimposed on the surface topography at the Galveston County site.

Committee III - Training Soil Scientists

Chairman: H. H. Bailey

Vice-Chairman: E. R. Blakely

| Members: | | | |
|---|---|---|---|
| | B. L. Allen | J. C. Meetze* | B. J. Wagner |
| | R. E. Caldwell* | D. D. Neher* | |
| | W. W. Frye* | R. P. Sims* | |

Charges:

1. Develop a core curriculum for students in soil science.

2. Develop a training guide for field soil scientists.

Committee Report:

Charge 1

At the committee's conference, at Oklahoma City, it was agreed that the committee should center its concern on Charge 1. Further, concern was to be centered on a listing of those courses that are related to an applicant's admission into the USDA-SCS (or equivalent agency) as a soil scientist.

Basically, the requirements are stated as 15 hours (semester) of soil science plus 30 hours of other related science courses. Recently, additional evaluations have been made as to the number of course hours taken under the general headings of:

| Plant, Animal | Geology | Math, Economics, Statistics | Chemistry, Physics |
|---|---|---|---|

In general, maximum "points" are granted when 10 semester hours (15 quarter hours) have been taken in each listed category.

Since numerous questions have been raised as to the courses that should be allowed in each category, the committee offered the following:

Soils courses - general requirement

Introductory Soils, with laboratory
Soil Genesis and Classification
Soil Morphology and Mapping
Soil Chemistry

*Not present at conference.

Soil Physics
Forest and/or Range Soils
Soil Fertility and/or Fertilizers
Soil and Water Conservation
Drainage, Irrigation, and Erosion Control
Soil Mineralogy
Soil, Plant and Water Relations
Soil Geography
Soil Biology
Soil Microbiology
Soils and Land Use (Interpretations)
Soil Judging
Soil Micro-Morphology
Soil-Plant Analysis
Saline-Alkali Soils
Soil Mechanics

<u>Plant, Animal</u>

Plant Identification and Taxonomy
Dendrology
Silvicultural Practices
Plant Physiology
Plant Ecology
Crop Ecology
Wildlife Ecology
Introductory Botany
Field Botany
Introductory Biology
Introductory Zoology
Microbiology
Crop Management ("Crops")
Range and/or Pasture Management (Habitat)
Plant Pathology (Forest, Crop, Range, Pasture)
Feeds and Feeding (Animal Xutrition)
Introductory Animal Science
Introductory Plant (Crop) Science

<u>Geology, Geography, Earth Science</u> - modified from simply Geology

Introductory Historical Geology and/or Geography
Physical Geology
Physical Geography
Geomorphology/Physiography
Sedimentation/Sedimentology
Mineralogy/Crystallography
Hydrology/Ground Water Geology
Glacial Geology
Conservation/Land Use Planning
Aerial Photography/Photogrammetry/Remote Sensing
Stratigraphy

Meterology/Climatology/Atmospheric Science
Land Reclamation (including waste management)
Petrology/Optical Minerology
Geo-Chemistry
Clay Minerology
Urban Geology

Mathematics, Economics, Statistics, Computer Science -
Computer Science added.

College Algebra (NOT remedial)
College Trigonometry or Pre-calculus Mathematics
Calculus
Agricultural and General Economics
Statistics
Computer Science

Chemistry, Physics

General Chemistry and laboratory
Organic Chemistry and laboratory
Physical Chemistry and laboratory
Quantitative/Qualitative/Analytical Chemistry
General Physics and laboratory

In addition, the following courses are considered to be highly desirable.

Communications/English - written and oral
Logic
Law (applied)
Management (organizational and personal)
Etymology
Finance (organizational and personal)

NOTE-Postscript from Committee chairman -
-A person not going to graduate school should probably be encouraged to have geology and/or geomorphology in preference to "additional" chemistry/physics courses. Those going to graduate school would probably want to emphasize chemistry/physics at the undergraduate level with geology/geomorphology taken at the graduate level.
HHB

Charge 2

Due to restraints of time Charge 2 was not adequately covered. However, the committee suggested that additional study should be made of the SCS Personnel Training Handbook and the critiques of the South Technical Service Center's two week training course for new soil scientists so as to fully develop the charge. Further, it was suggested that the following introductory terminology be considered to assure multi-agency use or acceptance of the training guide:

General Agency Organization and Training

1. Agency history

2. Agency Organization (as appropriate)
   2.1 Line and staff organization
   2.2 National office(s)
   2.3 Technical service center(s)
   2.4 State office(s)
   2.5 Field or local office(s)

3. Agency working arrangements with Conservation Districts or other units of government.

4. State office or other agency office level orientation and tour(s).

5. Training from appropriate disciplines, such as:
   5.1 Agronomy
   5.2 Range conservation
   5.3 Forestry
   5.4 Biology
   5.5 Engineering
   5.6 Others

Recommendations:

1. The course listings of this report be circulated to appropriate agencies and schools for their information and consideration.

2. That this conference recommend that the 15 semester hours of soils, required of a Soil Scientist, include a course in soil morphology and/or classification.

3. That the committee be continued with the primary charge of further developing a training guide for field soil scientists.

4. That this report be accepted.

Report accepted.

COMMITTEE IV - Soil Surveys for Land Assessment and Taxation

Chairman: B. L. Harris

Vice-Chairman: Glenn Kelley

Members: C. L. Girdner, R. L. Googins*, Wayne Hudnall, R. A. McCreery*, Charles McElroy, B. R. Smith, J. Soileau

Committee Charges and Goals:

1. Determine to what extent soil surveys are being used for taxation and land assessment purposes.
2. Evaluate and describe the different methods of using soil survey information for these purposes.
3. Discover current ways of making methodology and information available to users of soil surveys for these stated purposes.
4. List advantages and disadvantages of using soil surveys for taxation and land assessments.
5. Determine what other types of information are needed, and the techniques for interfacing that information with soil surveys for land assessments.

Committee Approach:

This committee expanded the charges to cover the entire 50 states rather than restricting consideration to only the Southern Region. In doing so the 50 states were divided up among the committee members for canvassing. A set of questions was devised to provide for uniform responses to the charges. Each state received at least two contacts and requests for information. Contacts were made in all states with the SCS State Soil Scientist, Extension Soils Specialists, and Experiment Station researcher. In many states contacts were made directly with county and state taxation officials. Committee members reported individually during the Work-Planning Conference in Oklahoma on March 16-20, 1980. However, considerable written and verbal communications took place before and after those meetings in compiling required data for completion of this report.

Responses to Charges:

1. Extent of soil survey for land assessment and taxation by States.

As indicated in the preceeding section, contacts were made with knowledgeable individuals in each state to determine soil survey uses for these purposes.

Results were:

| No Response | None Used | Very Little Used | Some Used | Commonly Used |
|---|---|---|---|---|
| 6 | 6 | 12 | 11 | 15 |

These data show that slightly over 50 percent of the states are actively using soil survey information as the basis for their land value assessment and taxation programs. Extent and level of usage vary. Presently 28 percent of the states have agricultural use-value legislation with use of soil survey information rapidly spreading to statewide usage. Indications are that other states will follow this trend. Few states have more than three years experience with use of soil survey data in their taxation base and assessment determinations.

Those states from which no response was received are Virginia, Rhode Island, Georgia, California, Kansas, and Montana. The committee did not have adequate information to project a level of soil survey data use in these states.

2. Evaluate and describe the different methods of using soil survey information for these purposes.

Generally Order 2 soil surveys with 1:15,840, 1:20,000, or 1:24,000 scale maps are used. Detailed soil survey data is being used. General soil maps are not being used except for some forestland assessment programs. Where detailed information is not available, few assessors employ general soil maps. Soil surveys are used for agricultural and silvicultural lands but not for urban or developed lands. In a few cases soil survey information is being used for assessment of "waste lands".

Mapping units form the basis of valuation systems not soil series or other broader categories. Data derived from such use of mapping units is then consolidated into broader groups'for taxation purposes. Examples of data interfacing are given later.

3. Current ways of making methodologies and information available to users of soil surveys for these purposes.

Most of the contacts and interactions currently have been on the state level. Several states have had meetings between assessment/taxation officials and SCS, Experiment Station, and Extension personnel. In many states agency personnel have worked together to develop suggested approaches.

In some states educational programs regarding use of soil survey data have been developed for assessors directly. These have been quite limited, however, mass media has been used in some states to publicize such soil survey uses. Radio and TV programs are commonly prepared and developed by Extension, and in some cases SCS personnel, regarding such uses for soil surveys. Generally these are of a general nature and cover few specifics.

Resource data and guidelines for soil survey uses for these purposes have been furnished by Soil Conservation Service, Extension, and Experiment Station personnel as requested. Meetings and discussions with assessors individually to describe the application of soil surveys also have been common in many states. Selected resource materials are listed in Attachment 1.

4. Advantages and disadvantages of using soil surveys for assessment and taxation.

Advantages:
(A) Uniform and equitable assessments within and between counties
(B) Reduces political bias
(C) Photo base (ease of orientation, etc.)
(D) Provides opportunity to remove tax on management
(E) Scientifically sound basis
(F) Provides means of determining "true" agricultural/ silvicultural values

Disadvantages:
(A) Lack of complete soil survey coverage
(B) Yield data in some cases unreliable; in many cases unavailable
(C) Assessors not familiar with data (soils)
(D) Political (adverse) implications of having soil survey associated with taxation
(E) Soils data sometimes needs adjustments for factors such as rock outcrops, alkali spots, etc.
(F) To match other data, soils maps are sometimes "blown-up" to large scales, implying greater accuracy than is present
(G) Initial accuracy of soil surveys occasionally limiting
(H) Lack of uniform intensity and scales
(I) Outdated surveys for many areas

5. Other types of information needed and techniques for interfacing this data with soil survey data.

Although variable from state to state and even within some states, the following types of information are used in conjunction with the soil survey data in taxation and assessment programs:

(A) Productivity data; crop yields, animal carrying capacities. site indices, etc.
(B) Climate
(C) Irrigation
(D) Drainage
(E) Land use
(F) Product values
(G) Capitalization rates
(H) Assessment ratios
(I) Taxation rate or millage
(J) Land value "modifers" -- stones, accessibility, uniformity, alkali, etc.
(K) Market value
(L) Rental or lease values

Perhaps the best way to evaluate specific applications of soil survey information and techniques of interfacing other information with soil survey data is to evaluate selected examples. Abbreviated descriptions of selected state assessment and taxation programs follow. These were selected to represent different approaches, not as recommended techniques. Each state is different. More detailed descriptions may be obtained by study of materials listed on Attachment 1.

New York:

- -Start with detailed soils information (grid used to determine acreage of mapping units)
- -Soils grouped based on productivity indices and/or capability classes
- -Taxation system includes 10 groupings of mineral soils and 5 groupings of organic soils
- -Climatic map overlaid (4 zones - 70 to 110% of reference)
- -Tax assessor assigns dollar values to be modified groups
- -Taxation rate determined and applied

Arkansas:

- -Soils combined into land capability classes
- -Yield data from SCS publications tabulated for capability classes
- -Weighted average yields computed for individual crops by land capability class groupings
- -Yields (SCS) adjusted with Crop Reporting Service average yields
- -Extension Crop Budgets used to obtain net returns to land
- -Apply severence tax statistics to timber
- -Income levels tabulated for crops for each capability class
- -Appropriate capitalization rate applied to obtain appraised value of each land capability class
- -Data then mapped (map used by assessors to tax parcels of land)

South Dakota:

- -Start with 1:20,000 or 1:24,000 scale soil maps
- -Productivity index determined for major crops
- -Valuation for each soil assigned by first determining market value of all the soils in production in a county, then assigning a value to each soil based on the productivity index for that soil
- -This derived value is then used by assessors for taxation parcels

Vermont:

- -Start with Order 2 surveys -- determine and tabulate mapping units
- -Determine productivity of soils from soil survey report
- -Assign soils to one of five agricultural productivity classes or one of four forestland productivity classes
- -Each Productivity Class is assigned a use value per acre calculated by capitalization of net returns to land
- -These values are then used by assessors for taxation purposes

Ohio:

- -Start with Order 2 survey -- determine and tabulate mapping units
- -Obtain Soil Management Groups and Land Capability Class from tables
- -Determine land use
- -Use tables developed for individual regions to arrive at per acre value and thus the value for a farm
- -This value is used by assessors for tax assessment

Recommendations:

Committee deliberations at the Work-Planning Conference and discussion with others involved in that conference lead to the following recommendations.

(1) The committee recommends a vigorous and systematic program of yield data collection and revision of soils interpretations to reflect these more accurate data
(2) The committee recommends that the use of capability classes be strongly discouraged for land assessment and taxation purposes
(3) This committee encourages the development of expertise at the regional level and a central collection of available information regarding use of soil surveys for taxation purposes. These materials would be made available on request

(4) The committee encourages soil scientist to actively seek inputs into development of assessment/taxation programs

(5) This committee should be continued for one more term to evaluate current taxation systems in the Southern Region and identify successes and problems of those taxation systems already in effect

ATTACHMENT 1

Selected Materials and Contacts Pertaining to Taxation and Land Assessment.

Several publications were collected by committee members during state by state canvassing activities. Those are listed below. These publications are employed by states actively using soil surveys for land assessment and taxation. By no means is this list complete; it is intended to identify a few excellent resource materials and people who were unusually cooperative and helpful. Those individuals supplied the publications listed and descriptions of their state programs which are not listed.

Arkansas:

-A New System of Rural Land Appraisal for Arkansas 1979 (9 pp.)

contact: Joe Greer
Assessment Coordination Division
305 Union Station - Markham & Victory
Little Rock, Arkansas 72205

Illinois:

-Illinois Appraisal Manual - Rural Section entitled The Assessment of Rural Property (10 pp.)
-The 1977 Illinois Farmland Assessment Act - An Overview (4 pp.)
-Memorandum of May 3, 1979 from Chief of Office of Financial Affairs to All Assessing Officials detailing Farmland Assessment Procedures (6 pp.)
-University of Illinois Department of Agricultural Economics newsletter entitled 79-2/Implementing the 1977 Illinois Farmland Assessment Law (4 pp.)
-State of Illinois Revenue Codes Ch. 120, par. 482, 501e

contact: R. A. Pope
Extension Agronomist
N-305 Turner Hall
University of Illinois at Urbana-Champaign
Urbana, Illinois 61801

Ray High, Appraisal Specialist
Department of Revenue
303 East Monro Street
Springfield, Illinois 62706
(Ph. 217/782-6956)

Indiana:

-Use of Soil Maps in Indiana's Farmland Reassessment (4 pp.)
-Land Valuation/Farmland -- The Soil Productivity Method (4 pp.)

contact: Joseph E. Yahner
Extension Agronomist
Department of Agronomy
Purdue University
Life Science Bldg.
West Lafayette, Indiana 47907

Iowa:

-Productivity Levels of Some Iowa Soils (23 pp.)
-Use of Soil Productivity Ratings in Evaluating Iowa Agricultural Land (4 pp.)
-Soil Survey Report Supplements for several counties (data to derive "corn suitability ratings")

Contact: Gerald A. Miller
Extension Agronomist
Iowa state University
117 Agronomy Bldg.
Ames, Iowa
(Ph. 515/294-1923)

Michigan:

-Chapter IV of Michigan Taxation Manual entitled Farm Land, 1972, (34 PP.)

contact: Neil W. Stroesenreuther
Assistant State Soil Scientist
Soil Conservation Service
1405 South Harrison Road, Room 101
East Lansing, Michigan 48823

Minnesota:

-Soils Fact Sheet No. 34 - 1980 -- Crop Equivalent Rating (2 pp.)
-Crop Equivalent Rating Guide for Soils of Minnesota (40 pp.)

contact: James L. Anderson
Extension Soil Specialist
Department of Soil Science
University of Minnesota
1529 Gortner Avenue
St. Paul, Minnesota 55108

**New** Jersey:

- Sixteenth Report of the State Farmland Evaluation Advisory Committee, 1979. (12 pp.)
- Soil Surveys for Natural Resource Inventories, 1979, (22 pp.)
- Your State in Farmland Assessment (leaflet)
- Farmland Tax Adjustment for Farmers Who Qualify and Apply (leaflet)
- Productive Capacity of New Jersey Soils (88 pp.)

**Contact:** Wendell C. Kirkham
State Soil Scientist
P.O. Box 219
Somerset, New Jersey 08873
(Ph. 201/246-1205)

**New** York:

- Soil Capability and Productivity Land Classification System for Agricultural Value Assessment (17 pp. + appendices)
- Land Classification and Climate Manual Agricultural Value Assessment (11 pp. + extensive appendices)

**Contact:** Lloyd E. Wright
State Resource Conservationist
Rm. 771, U. S. Courthouse & Federal Bldg.
100 South Clinton Street
Syracuse, New York 13260

Ohio:

- Current Agricultural Use Value Taxation of Ohio Farmland (16 pp.)
- 1979 Current Agricultural Use Value of Land Tables (15 pp.)
- Revised codes detailing Rules for the Valuation and Assessment of Land Qualified to be Valued at its Current Agricultural Use Value (22 pp.)

**Contact:** Samuel Bone
Extension Agronomist
Ohio State University
Agronomy
1885 Neil Avenue
Columbus, Ohio 43210

Richard B. Jones, Chief
Division of Lands and Soil
Ohio Department of Natural Resources
Fountain Square
Columbus, Ohio 43224
(Ph. 614/446-4910)

Oregon:

-Criteria for Determining Productivity Ratings for Oregon Soils (16 pp.)
-Agricultural Land Evaluation Model (22 pp.)
-Applications of the Agricultural Land Evaluation Model (8 pp. + worksheets)
-(Other mimeographed material detailing use and application of soil surveys for these purposes)

Contact: Dr. Herbert Huddleston
Extension Soils Specialist
Department of Soil Science
Oregon state University
Corvallis, Oregon 97330
(Ph. 503/754-2441)

South Carolina:

-Agricultural Use Value Manual for Assessors (130 pp.)

Contact: Dr. Bill R. Smith
Department of Agronomy and Soils
Clemson University
Clemson, South Carolina 29631

Texas:

-The Statement (monthly newsletter)
-Texas Property Tax Law Annotated (Vol. 1 & 2 + supplement approx. 1700 pp.)
-Guidelines for the Valuation of Open Space Lands (82 pp.)
-Taxpayers Rights, Remedies, and Responsibilities (12 pp.)
-General Appraisal Manual (750 pp.)

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**Vermont:**

Committee V - Updating Published Soil Surveys

Chairman: W. M. Koos

Vice-Chairman: J. F. Brasfield

Members: V. C. Carlisle, E. L. Cole, C. L. Fultz, D. C. Hallbick, R. W. Johnson, A. Newman, L. F. Ratliff*

Charges to Committee:

I. Determine reasons for updating published soil surveys.

A. Areas undergoing rapid land use changes to more intensive land use.

B. Soil survey not adequate for resource planning.

C. Soil survey not adequate to provide inventory and monitoring data.

D. Soil survey not adequate to identify soils that qualify as prime farmland and other farmland of local and statewide importance.

E. Soil survey not adequate for prescribing treatment for reclamation of lands that have been mined.

II. Outline factors to consider in evaluating existing published soil surveys.

A. Quality of soil base map.

1. The base map should be evaluated to determine:

a. Kind of base (photographic imagery or line map)

b. Land use changes

c. Compatibility of scale to land uses

d. Quality of imagery

e. Adequacy of culture features

For those soil surveys that were published without photographic base, it may be of some benefit to transfer lines to a photographic image.

*

B. Land use changes.

This is considered a high priority reason for updating a soil survey, only if the existing soil survey was not designed to meet current planning needs.

1. In consultation with key users, review existing soil map to determine the extent and location of land use changes.

2. In consultation with key users, review existing soil map to determine the acreages of surveys where existing survey does not provide adequate data for current planning needs.

3. Review map unit description to determine if adequate data are provided for current planning needs.

Land use changes should be considered in combination with other reasons for updating. Scattered tracts of land can be resurveyed as needed to meet current planning needs.

C. Quality and completeness of soil interpretations.

1. In consultation with key users, evaluate the kinds of interpretations in the publication.

2. In consultation with key users, evaluate the quality of soil interpretations for current planning needs.

3. Determine the availability and adequacy of laboratory data for soil interpretations.

The committee thinks that lack of adequate soil interpretations or the soil interpretations not being current, is a major deficiency. Current interpretations need to be provided either as a supplement or in a new published survey as recommended in an evaluation plan.

D. Adequacy of taxonomic unit.

It is a general concensus of the committee that many older surveys do not have descriptions of representative pedons that can be classified in soil taxonomy. This in itself is not a high priority reason for remapping, if the mapping units have been consistently mapped. A representative taxonomic unit can be identified that will provide a basis for soil interpretation for the needed uses, if there is a consistency between delineations.

1. Make an analysis in the published text of each soil series and range in characteristics to determine:

   a. Proper classification in soil taxonomy

   b. Overlap with other series

   c. Overlapping of subgroups in soil taxonomy

   d. Percentage of soils in survey area unclassified

2. If significant taxonomic units cannot be properly classified, the range in characteristics is not in the publication, or there are overlaps with other soil series, consideration should be given in the evaluation plan for updating the survey.

E. Map unit composition and consistency between map units in the survey area.

1. Most older soil surveys lack descriptive material on the composition of mapping units. Determine if map unit descriptions in the published document adequately characterize the map units.

2. Inconsistency between delineations of the same map unit is a major factor in reducing credibility of a soil survey. A number of methods have been proposed and/or used to evaluate map unit composition. The committee recommends a systematic sampling method to evaluate the accuracy of soil boundaries and the adequacy of map unit detail by one or both of the following or by a similar procedure or procedures:

   a. Locate transects in selected map units and study random select transects for determination of composition and consistency of mapping.

   b. Locate a random selection of tracts of land and remap according to present standards and criteria.

iompare the new information with existing mapping and evaluate in relation to the present and projected needs and uses of the surveys.

F. Adequate phase separations.

In survey areas where a phase separation has not been made, such as slope, flooding, erosion, salinity, etc., and are critical to the major interpretation of the map, the committee thinks the need for adequate phases is justification for updating the survey.

G. Quality and completeness of map unit descriptions.

1. Review each map unit description in the published document and determine if information relevant to land use, treatment and interpretations is adequate and current.

III. Prepare an evaluation plan to be used in developing alternatives for updating published soil surveys.

A. Recommendations

1. A copy of the committee report be provided to the Assistant Administrator for Soil Surveys to be used in preparing National Soils Handbook policy and guidance.

2. Recommend the committee be discontinued since charges are completed.

EXHIBIT NO. 1

# EVALUATION PLAN FOR UPDATE OF SOIL SURVEY

FOR

__________ SURVEY AREA

__________ 19 ____

## I. GENERAL INFORMATION

Acreage of Survey Area __________

Date field work completed __________

Date of publication __________

Number of copies of published soil survey available __________

Map scale __________

## II. ADEQUACY OF SOIL BASE MAP

Date of photography of map sheets __________

Type of soil base map.

Line Map ______

Photobase map ____

Map scale meets planning needs __________

Significant land use changes __________

Culture detail adequate __________

III. ADEQUACY OF TAXONOMIC UNITS

Number of Representative Pedons unclassified ________

Number of inactive series _____

Number of pedons not properly classified ___________

Number of pedons overlapping other subgroups ________

Percentage of soils in s-y area unclassified ______

IV. [illegible] ______________________________________________

________ ________ __________

| Field Name | Acres Mapped |
| --- | --- |

V. AVAILABLE LABORATORY DATA (List data, all sources)

VI. SOIL INTERPRETATIONS

Kinds of interpretations in published surveys:

1. Estimated yields ______

2. Engineering test data ______

3. Estimated characteristics significant to engineering ______

4. Woodland suitability groupings ______

5. Wildlife habitat ______

6. Rangeland ______

VII. MAJOR LAND USE CHANGE

Estimated acreage of major land use change.

VIII. OTHER FACTORS

IX. ALTERNATIVE RECOMMENDATIONS:



1. Reprint text and maps of the survey area.

2. Prepare a new base map and t-fer soil delineations end symbols.

3. Prepare a supplemental text with no remapping.

4. Partially remap, correlate and prepare a supplemental text.

5. Complete resurvey when taxonomic unit concepts end map units in more then a few parts or in most of the survey need revision to meet current needs.

6. No action required, published survey is adequate for present needs.

EXHIBIT NO. 2

EVALUATION PLAN FOR UPDATE OF SOIL SURVEY

FOR

Bolivar County, MS. SURVEY AREA

January 19 80

I. GENERAL INFORMATION

Acreage of Survey Area 586,880

Date field work completed 1951

Date of publication 1958

Number of copies of published soil survey available 930

Map scale 1:20,000

II. ADEQUACY OF SOIL BASE MAP

Date of photography of map sheets 1 9 5 0

Type of soil base map.

Line Map No

Photobase map Yes

Map scale meets planning needs Yes

Significant land use changes Yes

Culture detail adequate Yes

## III. ADEQUACY OF TAXONOMIC UNITS

Number of Representative Pedons unclassified 1

Number of inactive series 5

Number of pedons not properly classified 0

Number of pedons overlapping other subgroups Unable to determine

Percentage of soils in survey area unclassified 10

## IV. MAP UNITS NEEDING REMAPPING, RECLASSIFYING AND CORRELATING.

EXHIBIT NO. 2

-Page -3-

(Continued)

| Map Symbol | Field Name | Acres Mapped |
|---|---|---|
| Sm | Sharkey-Clack soils, nearly level phases | 3,242 |
| Sn | Sharkey-Clack soils, gently sloping phases | 847 |
| SO | Souva soils | 1,163 |



TOTAL ACRES: 191.814 or 28% of county

V. AVAILABLE LABORATORY DATA (List data, all sources)

EXHIBIT NO. 2
we-s-

VIII. OTHER FACTORS

Estimated acreage of land cut or filled at least 24 inches 4,000 ac.

Estimated acreage of land cut or filled at least 10 - 20 inches 18,000 ac.

IX. ALTERNATIVE RECOMMENDATIONS:

Fourteen map units comprising approximately 191,800 acres or 28 percent of the survey area are undifferentiated units, miscellaneous land types, inactive series or pedons unclassified. These units are scattered throughout the county. Another 22,000 acres have been cut or filled between 10 and 24 inches. Taxonomic units have no range in characteristics, therefore class limits cannot be determined. Map unit descriptions lack current data on use and management, treatment needs and non-farm limitations. The only soil interpretations are estimated crop yields. These are not current yields.

The survey is about 30 years old. In view of the age of the survey and limitations listed above, it is recommended that this survey be remapped and a new publication prepared.

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## Committee VI - Remote Sensing in Soil Survey

Chairman: Carter A. Steers

Vice-Chairman: Dave E. Pettry

| Members: | | |
|---|---|---|
| | Pete Avers | W. I. Smith |
| | R. H. Griffin, | Allan Tiarks |
| | Horace Huckle | Arville Touchet |
| | Robert W. Johnson | DeWayne Williams |
| | Frank Miller | J. C. Williams |

Charges to Committee:

I. Sponsor a short remote sensing symposium on field techniques for soil survey conducted in Southern States.

II. Publish report of the papers as a monogram sponsored by the Southern Regional Technical Work Planning Conference of the Cooperative Soil Survey.

The papers presented during the remote sensing symposium exemplify the various phases of soil survey projects the South is engaged in. Abstracts of these papers are to be included as a part of the conference proceedings.

We are not suggesting this work includes all operational soil related remote sensing projects of the South. Most states are now involved in some form of remote sensing field testing and we feel the work planning conference can be a means of data assimilation.

III. Recommendations

A. The symposium papers be cleared through normal channels for publication as a monogram sponsored by this work planning conference.

B. Expand use of ground penetrating radar of colored and colored infrared photography and of multiscanner imagery for soil survey.

C. The remote sensing committee be continued! if for no other reason than to keep the conference Informed of soil survey remote sensing activities in the Southern States.

"Not present at conference

# REMOTE SENSING IN SOILS/FOREST PROGRAMS BY THE U.S. FOREST SERVICE IN THE SOUTH

Peter E. Avers

The National Forests in the South are utilizing several kinds of remotely sensed data in on-going management programs and pilot projects. Over the last ten years use has evolved from almost exclusive black and white aerial photos to mostly natural color and color infrared photography. Other types used are high altitude quad-size ortho photos, optical bar photography and landsat imagery.

## Natural Color

This photography is commonly used as base field sheets in making soil resource inventories. It is leaf-off and generally at a scale of 1:24,000. Since the natural color distinction between pine and hardwood is clear, this aids in soil boundary placement. In upland hardwood areas, different landforms can be readily distinguished. Streams, wet soils, floodplains, severly eroded areas and rock outcrops can be determined. Natural color photography is used for a variety of on-going management activities and is on a seven year acquisition schedule for all Rational Forests.

## Color Infrared

This leaf-on photography is commonly used as reference in making soil inventories, rarely as a base map. Scale in coastal plains Forests is usually 1:12,000, and 1:24,000 in the mountains. Color infrared holds much promise as an effective aid in making quality soil inventories. However its use can be complex and personnel need formal training for proper interpretation. The Southern Region formed an advanced photo interpretation training course with the USGS at the National Space Technology Laboratories at Bay St. Louis to train foresters, engineers, soil scientists. etc.

Trained personnel can make determinations on locating the following conditions:

1. Soil moisture classes, particularly wetlands.

2. Vegetation vigor which is helpful in locating sources of gravel, disease incidence, insect infestations, low nutrient soils and eroded soils.

3. Pine versus hardwood and distinctions between hardwood species.

4. Tree height (±3') and crown size which can be correlated to diameter.

5. Vegetation patterns provide clues to landform location and soil boundary placement.

Color infrared is valuable for many resource inventories and is used by Foresters in making silvicultural prescriptions. This photography is also on a seven year acquisition schedule on all National Forests.

Optical Bar Photography

This is high altitude color infrared leaf-on photography taken with a Drone Camera that swings perpendicular to the flight path giving a panoramic picture, 4.5" x 50", covering a 22 mile wide swath. It is currently used for forest insect and disease detection and timber salvage operations. The entire state of South Carolina has been flow" as a pilot effort in connection with the multi resource inventory project. Also, optical bar imagery has bee" acquired over the National Forests in Texas. There is distortion on the edges because of the wide range of the camera. However, it is economical and has value for reconnaissance, cultural feature update, and general resource inventory of land use conditions. It can only be obtained thru NASA. There is not a commercial source at this time.

Landsat Imagery

This, like the optical bar photography, is still being studied for regular use. It is handled primarily thru the Forestry Applications Program, a Forest Service group at Houston, NASA Johnson Space Center.

It will be used in conducting the multi resource inventory project in South Carolina and on the Tuskegee National Forest in Alabama. Ground truth data from U.S. Forest Service permanent continuous forest inventory pilots will be correlated with images to aid in resource inventories. This imagery is good for overview and in determining broad vegetative and land use patterns. A high potential apparently exists for using computer generated landsat data in resource inventory display systems and in interpreting landscape features to aid in making soil surveys. Study on the use of this imagery is continuing to aid forest management programs.

# The Use of a Landsat-Based Information System by Local Government

W. Frank Miller, Bradley D. Carter, Dale A. Quattrochi
Remote Sensing Applications Program
Mississippi State University

Personnel of the MSU Remote Sensing Applications Program have developed a Landsat-based information system for Lowndes County, Mississippi, in cooperation with the Golden Triangle Planning and Development District and with the Board of Supervisors, the Civil Defense Director, and the Tax Assessor of Lowndes County.

The information system is cell-based with a 5 ac grid, and contains in addition to land cover derived from analysis of Landsat digital data, 15 primary variables and 17 secondary variables. The primary variables were digitized directly from aerial imagery, and geologic, soil and highway maps, while terrain information was obtained from digital terrain tapes (NCIC); these variables concern physical, cultural and biological characteristics of the land. The secondary variables are proximity variables; i.e., number of cells from a certain variable, subvariable or group of subvariables. Examples of a primary and a proximity variable with their subvariables are Soil Association - Leeper/Catalpa, Smithdale/Sweatman, Sumpter/Kipling; Slope/0-2%, 2-5%, 5-B%, 8-12%, 12-17%, and 17-45%; Proximity to First Order Stream - in cell, 1 cell away, 2 cells away, n cells away.

When the data base was completed, suitability models were developed through the use of the Computer Assisted Land Use Planning (CALUP) software package. A model defines the suitability of a cell for a given use or function based upon the vulnerability of a landscape unit to a given use or function, and the attractiveness of the unit for the use or function. Attractiveness can be defined in terms of economic and/or aesthetic parameters. Model development was based upon input from the cooperating agencies. Model output is in the form of either hard copy, line printer maps from the UNIVAC 1100/80, display on the color CRT screen of an interactive graphics system, or a STATOS plotter hard copy output from the system; the information system is interactive on a DG Eclipse minicomputer.

Models which have been produced illustrate, for example, those 5 ac cells in the County which have a high suitability for residential, high volume commercial and industrial construction sites, sanitary land-fill development, and intensive recreational site development. The models were developed for use by the Golden Triangle Planning and Development District. Major use of the data has been made, however, by the Civil Defense Director. Working with Program personnel, a series of flood hazard maps of the County was developed. Several of the model maps (a high frequency flood model and a high potential crop flood damage map) were utilized in a subsequent flood even in April 1979. Based on these models, the following actions were taken or decisions made :

1. Prior to the flood, two areas, heretofore unrecognized, were identified as flash flood hazard zones, and were recommended to the Regional Flash Flood Hydrologist for inclusion in a Self-Help Program;

2. The crop flood damage map was utilized to dispatch agricultural damage assessment teams following the flood crest.

3. The high frequency flood map was also utilized to dispatch urban damage assessment teams and "increased the responsiveness of disaster relief agencies." Recommendations are now being made concerning placement of emergency equipment during high water periods, and also for day-to-day storage. Hazard vulnerability models are also being developed for zones of high potential traffic, rail, industrial and air accidents, and forest fire.

Models illustrating lands in need of drainage, areas of urban expansion, and sources of non-point source pollution were supplied to the Lowndes County Conservation District and the information was used in developing long-range objectives. Efforts are continuing to implement a variety of uses in other branches of local government in Lowndes County; the Tax Assessor is considering the use of the crop damage model for tax reduction on crop lands subject to late spring and early summer floods.

To date, the majority of the models have utilized land cover information acquired from Landsat and soil association/terrain information acquired from the Soil Conservation Service and the National Cartographic Information Center. Selected areas of the County are being digitized using soil mapping units as one of the input variables in order to achieve finer delineation of use potential.

# COLOR IR AND SOIL SURVEYS IN LOUISIANA

by

B. ARVILLE TOUCHET

## ABSTRACT

Color IR imagery has been used with success in refining soil survey delineations in the Mississippi-Arkansas River alluvium in Morehouse Parish, Louisiana.

Landforms were very pronounced on the ground but could not be located accurately on the black and white imagery used in soil mapping because the land use pattern overrode the landform signatures. After using the color IR in the field for a while, the field men could read the landform signatures and plot them accurately on the soil survey mapping material.

Color IR imagery has been used with much success in delineating vegetative regimes in the coastal marshlands of South Louisiana. Ground truth sites are plotted on topoguad sheets and recorded using helicopters for accessing the sites. Color IR imagery is very sensitive to vegetative changes. The data and the IR signatures are matched enabling the soil scientist to delineate the saline, brackish and fresh water marshes.

# EVALUATION OF VARIOUS KINDS OF AERIAL PHOTOGRAPHY FOR USE IN SOIL MAPPING

by

ROSS W. LEAMER, JERRY L. JACOBS, FRED E. MINZENMAYER, AND DEWAYNE WILLIAMS

## ABSTRACT

The purpose of this study was to determine whether color infrared and color aerial films contain more visual information for separating soil map units as compared to conventional black and white aerial film. Three geographic areas of contrasting soil types were mapped using color IR and color aerial film. This mapping was compared to previous experience with black and white aerial film. The study resulted in both an increased mapping rate per hour and an increase in accuracy or quality of the soil mapping when using color IR or color aerial film as compared to conventional black and white aerial film. This study indicated that both color IR and color aerial film is capable of detecting more visual information than black and white aerial film, especially in areas of variable soil/color contrasts. This capability has definite possibilities for use in soil mapping in separating soil map units.

# APPLICATION OF GROUND PENETRATING RADAR IN SOIL SURVEY

by

R. W. JOHNSON, R. GLACCUM, AND R. WOJTASINSKI[1]

## ABSTRACT

Historically, soil surveys are made by soil scientists walking over the land and examining the soil with various types of soil augers. The number of auger observations made to classify the soil and to delineate soil boundaries is limited because of time and money. The quality and quantity of soil surveys could be expedited if a faster and less laborious method were used to examine the soil.

The purpose of this study was to demonstrate the feasibility of using ground penetrating radar as a tool for making soil surveys. Other objectives were to recommend improvements in the radar system for this purpose, and to suggest operational procedures for using ground penetrating radar in soil survey.

The equipment was tested at two locations in central Florida. Both areas had existing level two surveys showing a number of contrasting soils. Approximately five miles of transects were run with the radar equipment. Ground truth was obtained from auger borings every one hundred feet along the lines of transect in addition to comparison with the completed soil maps. The resulting radar data was generally of excellent quality. A high degree of correlation was obtained between the radar data and major soil horizons and the existing soil maps. The study indicates that ground penetrating radar can be effectively used in soil survey to provide quantitative estimates of mapping unit composition.

[1]State Soil Scientist, SCS, USDA Gainesville FL; Geologist Technos, Inc., Miami, FL; Electrical Engineer: NASA, Kennedy' Space Center, FL.

# MAPPING OF TIDAL MARSH SOILS BY FALSE COLOR IMAGERY IN MISSISSIPPI

by

WILLIAM I. SMITH

## ABSTRACT

A field study was made in Hancock County, Mississippi to evaluate the use of three types of remote sensing imagery for use in soil surveys. The three types of remote sensing imagery, which were available locally, were conventional black and white photographs, false color infra-red transparencies, and 26 channel multi-spectral scanner imagery, displayed on a color television type screen. False color infra-red imagery enhanced vegetative and soil differences in the rugged, almost inaccessible tidal marshes. Use of this false color infra-red imagery in conjunction with conventional black and white photographic base maps resulted in accelerated mapping rates and improved soil survey map quality, and the recognition of extensive areas of mineral soils, soils which had never been mapped in these areas.

May 1980

# BREWSTER COUNTY, TEXAS, COMPUTER ASSISTED SOIL SURVEY USING LANDSAT IMAGERY AND DIGITIZED REFERENCE OVERLAYS

by

JACK C. WILLIAMS
TEMPLE, TEXAS

## ABSTRACT

An Initial Field Review of Brewster County was held in 1978. Also, an agreement with the National Park Service to make a soil survey of Big Bend Park by September, 1981, was signed.

Brewster County contains about 3,985,000 acres. Big Bend National Park, in the southern part of the county, contains about 708,000 acres. Rainfall in Brewster County averages from 5 to 10 inches annually. The county is within the Trans-Pecos Land Resource Area, number 42.

The SCS and NASA Earth Resources Lab are working on a demonstration project to use LANDSAT data to speed up the soil survey of Big Bend National Park. Preliminary data has been of some assistance to the soil scientist working on the survey, however, thus far the results have been disappointing. It is hoped that additional refining of the LANDSAT data will (1) be reliable enough to separate ecological units, or soil mapping units, and (2) that LANDSAT data can project soil mapping units into the inaccessible and remote portions of the park. Most of the park is inaccessible to vehicles.

The preliminary data provided by NASA on a demonstration project basis has not been specific enough to delineate ecological, or soil mapping, units.

Selection of ground control points within the park was difficult because there were few recognizable man-made landmarks on the LANDSAT data. The training sites selected proved to be satistically unreliable to produce data printout sheets with mappable ecological units. Most remote sensing projects use LANDSAT imagery with data that records reflectance from vegetation. With the low rainfall in Brewster County, there is little vegetative cover and it appears that the satelite is picking up the reflectance from bare ground and rock.

Another problem anticipated is that the LANDSAT data developed in the park, where no grazing is occuring, will have to be recalabrated from use on grazed rangeland areas outside the park.

The demonstration project has not had enough input to make the LANDSAT data usable in the soil survey of Big Bend National Park. Indications are that usable data is probably available on the LANDSAT imagery. Funding is needed for this project to process the data into a usable form.

If reliable LANDSAT data can be developed, there are about 12 million acres in the Trans-Pecos Area of Texas yet to be surveyed where LANDSAT data can assist in the soil survey.

Committee VII - Soil Survey Educational and Informational Programs

Chairman: Vpsels.anJ:. Kleiss

Overview of Survey Results:

Response to the request for programs and ideas that have proven successful in various states was only fair which may or may not reflect the status of educational and promotional efforts in our Cooperative Soil Survey Program. None the less the responses did reveal an interesting range of activities among the states. Program efforts varied from nearly none to elaborate meetings involving senators and congressmen and very detailed workshops for specialized user groups.

The materials and suggestions which were shared with the committee were reviewed and provided a basis for highlighting of some ideas that may be of value. At least a sharing of some approaches may stimulate a renewed interest in our educational programs.

1. Planning for education and promotional programs

Perhaps the most important step for assuring the initiation of educational activities is the development of a formal agreement concerning the role of various agencies. This should be a more prominent and integral part of our various Memoranda of Understanding. A more specific clarification of responsibilities and a defined plan for particular programs would give greater visibility and priority. Including a detailed discussion in agreements at the county level may increase the role and priority of local personnel (SCS, Extension, etc.) in carrying out a program. This latter consideration seems very critical to a successful program.

In many instances heretofore the responsibilities may have been sufficiently vague that the proper leadership was not provided. A more definitive description of responsibilities and an itemization of the types of programs expected would provide a more likely framework for a successful and continuing program.

2. In-service training for local personnel

It is becoming clear that as the numbers of surveys increase, it is more difficult for staff at the state level (SCS, Extension, Exp. Station) to conduct the necessary educational programs. Since local personnel are much more able to ascertain the optimum "teaching moment" they should be prepared to carry on the program. The capability as well as the desire of county staffs to undertake programs dealing with the soil survey is to say the least quite variable. It seems therefore that a significant portion of our effort should be directed toward preparation of those at the "local" level. This should include not only training but also provision of materials and aids for use by these individuals.

Many of us have witnessed or indeed been a part of the scenario wherein state level personnel come into a county or survey area with their "bag of tricks" and put on a program, then pack up and go home leaving a void which the local people may not be able to fill or at least not be able to carry on with continuity. It would be most desirable if the appropriate local people are prepared and take an active part such that they become identified as the experts in the use of the soil survey.

As this a cooperative program it is important that in-service training be provided on a joint and cooperative basis. Joint training workshops could be designed to promote cooperative programs in the counties and thus reduce possible misunderstandings of educational responsibilities.

3. Types of Programs

The kinds of promotional and educational activities that have or could be undertaken are numerous and limited only by our imagination. It is the consensus that programs must be tailored to a specific audience to be effective and thus require local inputs. The approach that seems preferred is one planned before a survey begins and initiated at the outset of the survey process.

a. Memorandum of Understanding

The educational process should really begin as the initial arrangements and contractual agreements are being developed. A complete understanding of responsibilities and of the nature of the ultimate survey product must be achieved to assure a smooth process and minimize future misunderstandings among all parties involved. In some cases it may even be desirable to spend time in the field illustrating to the local agencies what they are getting for their investment. At this early juncture a mechanism for exchange of information can be established that can pay dividends throughout the course of the survey. If the local agencies have made input into some of the early decisions on such matters as scale and intensity of mapping and feel as though the survey is indeed theirs, then a good foundation has been lain for future support.

As stated previously, an integral part of the agreement should be an outline with responsibilities for future educational efforts. This would place some priority on these activities and provide initial planning.

b. First acre ceremony

One activity that has been used to gain early publicity as well as provide initial understanding of the survey procedure is a first acre ceremony. This ceremonial soil boring and drawing of a mapping unit boundary can provide a focus for a local "media event" especially if appropriate dignitaries are participating.

c. Activities while survey is in progress

The field party is often overlooked in terms of opportunities for continued education and yet is most capable of communicating the detailed soils information. A planned effort of interaction with potential user groups perhaps by spending a few hours in the field with the party leader would accomplish more in terms of understanding a soil map than a great deal of talking in a formal workshop at a later date.

If the concept of soil potentials is to be developed as presently advocated, considerable local input will have to be made during the course of the survey. This itself will require education of various "land use experts" so as to acquire their input on locally acceptable management practices. Regardless of local development of "potentials" the survey party should evaluate present interpretations with various local professional people and in so doing would familiarize various groups with the soil survey and its use. Using "local" input in the design of mapping units will also require an educational effort and will stimulate user interest.

Part of the in-service training of District Conservationists, Extension Agents and others, who will have to carry on the educational efforts after the survey party is gone, could also be formally undertaken while the survey is in progress. Perhaps a greater effort to include these individuals in regular field reviews would be very useful.

A simple step that would achieve a continuous awareness of the soil survey effort would be regular items in the local newspaper noting where the party was working and the kinds of soil conditions or soil problems that occur in the specific area. This could be designed as a planned series of short articles which would eventually cover all major soil regions and thus would not only maintain a visibility but would also disseminate a lot of soil information and create some interest in the survey area.

d. Interim reports

As significant portions of a survey area are completed, especially, where the demand for soil information has been strongly expressed, an interim report has been commonly prepared. The availability of such a document provides a good opportunity for some local workshops and programs in how to use the information. This is the first good chance for illustrating the use of soil maps and interpretive material. A field trip as part of this effort would provide hands-on experience in recognizing soil properties, in distinguishing soil series, and illustrating soil related land use problems. It seems that a significant deficiency in many of our educational efforts in promoting the use of soil information has been the lack of in-field education. In many of our workshops we speak of conditions and limitations and name soil series but until someone has actually seen these they cannot fully understand our meaning nor appreciate the land use interpretations. The same problem exists in understanding map scale and mapping unit characteristics. Having this in-field experience at an interim stage while the local interest is at its peak rather than waiting until the published report stage seems most desirable.

e. Final acre ceremony

An activity planned around the completion of mapping has been used successfully in some cases to achieve some visibility for the soil survey program. This event normally includes representatives of all the cooperating agencies especially the local groups if they have been involved in the funding. Normally this event is not designed to present any technical information but rather as an overview and recognition of this milestone.

f. After survey is published

The availability of the final published survey has usually provided the impetus for greatest amount of educational and promotional activities. This effort seems best accomplished through a series of workshops and meetings.

i. Kick-off meeting

This meeting has been used as a formal presentation of the published report often involving local Congressman, heads of the cooperating agencies, and local politicians and leaders to gain exposure and publicity. This meeting should establish the publicity, impetus and support for subsequent technical workshops.

ii. User workshops

Depending on the nature of the county, one or several workshops can be given to illustrate the use of the soil survey. This commonly may include a number of presentations from individuals representing various user groups, i.e., agriculture, land planning, engineering, waste disposal, etc. Following these discussions it is desirable to involve the participants in some exercises designed to require the use of various parts of the survey report. This allows the users to become familiar with the contents and nature of the information.

As various soils are named it would be desirable to have monoliths or profile slides illustrating the various soils as well as slides of typical landscape settings for these. The need for development of this material should be identified early so as to be acquired during the course of the survey.

If a high interest level has been achieved the workshop could be of sufficient length so as to allow some time in the field illustrating soil characteristics and soil series while depicting the relationship of the map to an actual landscape setting.

iii. Follow-up activities

After a major educational effort at the time of publication some follow-up activities would be in order even though seldom undertaken. When various groups have had some time to use the survey a subsequent workshop designed for a narrow range of users can be very productive. Such a workshop would provide an in-depth look at the survey with respect to assisting particular users. Activities may go beyond the standard interpretations into other uses of the base data or illustrate the integration of soil data with other natural resource information to assist in particular land management decisions. A number of these kinds of programs have been directed to sanitarians, forest managers, land use planners, erosion control inspectors, landscape architects, etc. Oftentimes special supplemental information must be put together to be most successful in these programs.

iv. Other opportunities

Local personnel (Extension Agents, District Conservationists, etc.) have many other opportunities for making a plug for the use of surveys which are often missed. Other meetings especially with particular commodity groups could be used for short promotional efforts. In general, the turn out for a corn or soybean growers meeting will be much greater than ever will the turn out for a soil workshop. These audiences could be used for dual purposes.

Getting on the program at local meetings of the landscape architects, society of civil engineers, homebuilders association, etc., are other opportunities. Development of materials for use in science classes in grade shcools and high schools could provide early exposure to this vital natural resource information.

Conclusion:

It is clear that education in the use of soil survey information is a continuing process. It will become increasingly necessary that county level personnel assume more of the responsibility. Much of the effort from the state level should be directed to in-service training, support with educational materials, etc., and guidance and assistance.

A renewed and perhaps evangelistic approach to the promotion and education in the use of soil information seems in order and a priority. The goal for completing surveys seems to have out distanced our ability for getting them effectively utilized. Continued strength and viability of the Cooperative Soil Survey is dependent on public support and use of this valuable natural resource information. This support requires a strong and continuous educational and promotional program and a committment for achieving this program at all levels.

Recommendations:

1. That this regional conference express its concern to the national level for recognition of stronger and direct educational programs.

2. That support and priority be given to educational and promotional activities in agreements at all levels of the Cooperative Soil Survey.

3. That this committee be continued to serve as a mechanism for communicating and exchanging ideas and for maintaining a renewed visibility for educational and promotional activities.

## Committee VIII - Soils of Coastal Wetlands, Their Classification and Correlation

Chairman: Arville Touchet

Vice-Chairman: T. R. Gerald

| Members: | | | |
|---|---|---|---|
| Members: | F. G. Calhoun* | C. T. Hallmark | Blake Parker |
| | Warren Cockerham" | Ernest Hayhurst" | |
| | Jim Driessen * | Wayne Hudnall | |

Background:

The need for proper classification, correlation, and mapping of soils in coastal wetlands for proper interpretations is forever increasing. Guidelines have been set for amending Soil Taxonomy to meet new demands and allow the establishment of new taxa where prudent. The need of new taxa to adequately classify soils of the coastal wetland is acute. Yet at present a unified effort in this regard to amend Soil Taxonomy has not existed. There has been however, two proposed amendments to Soil Taxonomy to classify soils of coastal wetlands, one from Texas and one from the West TSC.

This committee and its charges evolved from the needs incurred in the accelerated mapping of about 4.5 million acres of coastal wetland in Louisiana. However, efforts to incorporate ideas, proposals, and expertise from personnel in other states were made.

Introduction:

The preliminary work of the committee was done in a meeting at LSU with Bob Miller, Wayne Hudnall, J. P. Jones, Warren Cockerham, Jim Driessen, and Arville Touchet attending. Specific charges along with subject headings were developed and circulated to all committee members and 37 other soil scientists. The committee considered the previous proposals to amend Soil Taxonomy from Texas and the West Technical Service Center and the responses both verbal and written which were received from soil scientists not represented on the committee.

Charges to Committee:

I. To develop and test criteria and differentiae that are needed to classify soils in the coastal wetlands.

   A. Almyric properties

      1. Recommendations - That a Almyric Great Groups Criteria be defined and tested for Aquents, Aqualfs, and Aquods and Saprists and then propose the changes in Soil Taxonomy.

"Not present at conference

2. The committee recommends the following subgroups for the respective recommended Almyric Great Groups:

| | | |
|---|---|---|
| 1-Almyraquents | 2-Almyraqualfs | 3-Almyraquods |
| **Typic** | **Typic** | **Typic** |
| Salic | **Histic** | **Histic** |
| **Histic** | Hydric | |
| Hydric | Salic | |
| **Psammentic** | | |
| Lithic | | |
| Thapto-Histic | | |
| Sulfidic | | |

4-Almyrasaprists
- **Typic**
- Terric

B. Additional Subgroups to existing Great Groups

1. The committee recommends the addition of new subgroups for the following existing Great Groups:

| | | |
|---|---|---|
| 1-Hydraquents | 2-Psammaquents | 3-Fluvaquents |
| Almyric | Halic | Hydric |
| Sulfidic | | Hydric Vertic |
| **Histic** | | |
| Leptic | | |
| **Thapo-Histic** | | |
| Almyric **Histic** | | |
| Almyric Thapto-Histic | | |
| Almyric Leptic | | |
| Almyric | | |
| Almyric Haplic | | |

| | | |
|---|---|---|
| 4-Albaqualfs | **5-Ochraqualf** | 6-Argiaquolls |
| **Histic** | **Histic** | **Histic** |
| Hydric | | Hydric |

7-Sulfahemists
- Terric

II. To identify needed changes, additions, and further actions relative to existing taxonomic criteria relative to soils of the coastal wetlands.

A. Sulfidic material

1. Recommendation - Identification of sulfidic material be made by the moist incubation method. This method was first proposed by the "Working Party on Nomenclature and Methods," International Symposium on Acid Sulphate

Soils, Wageningen, 1973. The procedure involves incubation of moist soil at room temperatures for four weeks and then determining the pH of the saturated paste. A pH drop to below 3.5 would indicate sulfidic material.

B. Free carbonates

1. Recommendation - That observations be made by field men as to the possibilities of calcic horizon in these soils.

C. Degree of fluidity

1. Recommendation - That no additional breaks be made in Hydraquents except the present 0.7 n-value.

a. Comment - At present, the degree of fluidity is based on E-value. Precise measurements ofn-value is very time consuming and is an indirect attempt to obtain information on the bearing capacity of a saturated soil. The committee recommends the development, testing and correlation of a field penetometer specifically designed for the measurement of bearing capacity in sediments of high fluidity.

II:I. To develop sampling and laboratory procedures needed to characterize soils of the coastal wetlands.

A. Expression of data: Volume vs oven-dry basis

1. Recommendation - That since volume basis is more meaningful, especially for the understanding of soil-plant-water relationship in these soils, expressions of data be made on a volume basis. Further, the committee feels that these soils should not be dried before analysis.

B. Sampling equipment

1. Recommendation - That since minimum disturbance is desirable in sampling, research be pursued in new equipment for sampling.

a. Comments - Dr. Hudnall, LSU, is experimenting with a newly acquired split tube sampler. He will report on procedures as soon as data are available.

b. Additional Comment - The committee chairman will consult with TSC geologists on sampling equipment used for lake bottoms.

C. Procedures for characterization: (Histosols)

1. Recommendation - That laboratory personnel from the cooperating agencies and NSSL evaluate the existing procedures in characterization of Histosols. Evaluation should be done on obtaining CEC by ammunium acetate as compared to barium chloride.

2. It was further recommended that NSSL publish a Standardized Procedures Report for the characterization of Histosols.

D. Sample storage

1. Recommendation - That since wet samples should be used for analyses, the samples should be refrigerated to below biological zero (5°C) for storage.

## PROPOSED SOIL TAXONOMY CHANGES

Page 48 - Other Diagnostic Soil Characteristics

Add:

Almyric Soil Properties

Almyric soil properties refer to a cation-exchange complex with relatively high propertions of sodium and magnesium or a soil solution that is saline. An exchangeable sodium plus magnesium content more than 40 percent of the cation-exchange capacity and is typical of soils with at least 0.5 percent salt solution. In definitive terms, almyric materials have one of the following:

1. Exchangeable Na + Mg more than 40% of the NH4Ac CEC at pH7
2. Sum of soluble cations more than 80 meg/liter
3. Electrical conductivity more than 7mmho/cm

A soil must have a peraquic moisture regime and almyric properties in more than half of the upper 1 meter to qualify for a almyric Great Group or subgroup.

Page 92 - E, 1.a., revised to read, "are saturated with water within 1 m of the surface for 1 month or more in some years, but lack a peraquic moisture regime, and have a salic horizon ..."

Page 95-2. "... or have a peraquic, aquic, udic, ustic, or xeric moisture regime;"

Page 96 in Limite between Alfisols and soils of other orders. 1. a. A peraquic, aquic, udic ustic or xeric moisture regime;

Page 155 - 2.b., have a salic horizon whose upper boundary is within 75 cm of the surface and are saturated with water at a depth within 1 m of the surface for 1 month or more in most years, but do not have a peraquic soil moisture regime; or

Page 179 - 2.a., "... the upper boundary of the salic horizon must be 75 cm or more below the surface except those with a peraquic moisture regime, whereas the depth requirement is waived.

Key to Suborders

Page 96 HA "Alfisols that have a peraquic moisture regime or an aquic moisture regime . .."

AQUALFS, p. 109

Page 109 - Aqualfs-Most Aqualfs that have a peraquic moisture regime occur in the coastal marshes as a result of land subsidance. Many of these soils were once prairie soils but are today influenced by tidal flucuations. Many of these soils are too saline for crop production. Although not extensive, they are easily identified in the tidal marsh.

Page 109 - Key to great groups

Change HAA to read: HAA Aqualfs that have almyric soil properties in more than half of the upper 1 m.
**ALMYRAQUALFS** p. 114

Change:

the present HAA to HAB, HAB to HAC, etc for alphabetical order.

Add:

Almyraqualfs

These soils are Aqualfs that have a peraquic moisture regime and that have almyric properties in more than half of the upper 1 m.

These soils developed the horizons diagnostic for Alfisols and were subsequently flooded by seawater either by subsidence of the land surface or a rise in sea level. They occur along low coastal areas that are flooded by seawater often enough that they are never dry in the moisture control section and have one of the following: (a) a cation-exchange complex with relative high proportions of sodium and magnesium (b) a relatively large quantity of soluble cations or (c) a saline soil solution.

Definition

Almyraqualfs are the aqualfs that

1. have a peraquic moisture regime, and
2. have almyric properties in more than half of the upper 1 m.

Distinction between Typic Almyraqualfs and other subgroups:

Typic Almyraqualfs are the Almyraqualfs that

a. do not have a histic epipedon
b. have a n-value less than 0.7 in all horizons
c. do not have a salic horizon within 18 cm of the soil surface.

Histic Almyraqualfs are like Typic Almyraqualfs except for "a", with or without "b".

Hydric Almyraqualfs are like Typic Almyraqualfs except for b.

Salic Almyraqualfs are like Typic Almyraqualfs except for "c", with or without "a" or "b".

Descriptions of subgroups

Typic Almyraqualfs-Those submerged Alfisols that are influenced by tidal seawater. They have a peraquic moisture regime and are firm in all horizons throughout the profile. The presence of a fluid surface layer is the defining feature for the Hydric Almyraqualfs.

Histic Almyraqualfs-The presence of a histic epipedon is the result of perlong submergence and have supported marsh vegetation which has accumulated. The histic epipedon usually has an n-value more than 0.7.

Hydric Almyraqualfs-As sediments are deposited over the Almyraqualfs in a water environment, the materials never become consolidated and thus retain their fludity. These soils are not extensive except in the coastal marsh of Louisiana.

Salic Almyraqualfs-These soils are like Typic Almyraqualfs except that sufficient salts have been accumulated in the upper 18 cm to form a salic horizon. These soils occur adjacent to sea coasts and are partially or totally drained daily as a result of a fluctuating tide.

Page 181 - Key to Great Groups

Add:

JAC Other Aquents that have a peraquic moisture regime and have almyric soil properties in more than half of the upper 1 m.

ALMYRAQUENTS

Change:

the present JAC to JAD, to JAD to JAE, etc. for alphabetical order.

Page 184-add:

## Almyraquents

These soils are Aquents that have a peraquic moisture regime and that have almyric properties in more than half of the upper 1 m. These soils are located mainly along low coastal areas that are flooded by seawater often enough that they are never dry in the moisture control section and have one of the following: (a) a cation-exchange complex with relative high proportions of sodium and magnesium or (b) a relative large quantity of soluble cations, or (c) a saline soil solution.

### Definition

Almyraquents are the Aquents that do not have sulfidic materials within 50 cm of the mineral soil surface, and

1. have a mean annual soil temperature higher than 0°C;
2. have an n-value of 0.7 or less or have less than 8 percent clay in some or all subhorizons at a depth of between 20 and 50 cm;
3. have texture that is loamy fine sand or finer in some horizon below the Ap or a depth of 25 cm, whichever is deeper, but above 1 m or a lithic or paralithic contact, whichever is shallower.

### Distinction between Typic Almyraquents and other subgroups

Typic Almyraquents are the Almyraquents that

a. have an n-value less than 0.7 in all subhorizons between 20 cm and 1 m;
b. do not have a salic horizon within 18 cm of the soil surface;
c. do not have a histic epipedon;
d. have a texture that is loamy fine sand or finer in some horizon below the Ap or a depth of 25 cm, whichever is deeper, but above a depth of 1 m or a lithic or paralithic contact, whichever is shallower;
e. not have a lithic or paralithic contact within a depth of 50 cm;
f. do not have sulfidic material within 1 m of the mineral soil surface;
g. do not have a buried Histosol or a buried histic epipedon that has its upper boundary within 1 m of the soil surface.

<u>Histic Almyraquents</u> are like Typic Almyraquents except 'for "c", with or without "a".

<u>Hydric Almyraquents</u> are like Typic-Almyraquents except for "a".

Lithic Almyraquents are like Typic Almyraquents except for "e", with or without "d".

Psammentic Almyraquents are like Typic Almyraquents except for "d".

Salic Almyraquents are like Typic Almyraquents except for "b", with or without "a" and "c".

Sulfidic Almyraquents are like Typic Almyraquents except for "f".

Thapto-Histic Almyraquents are like Typic Almyraquents except for "g", with or without "a".

Typic Almyraquents

These soils are deep soils that are saturated in all parts of the moisture control section, and have an n-value less than 0.7 in the surface, have almyric properties in more than half of the upper 1 m, and have a texture that is finer than loamy fine sand between 25 cm and 1 meter. They do *not* have a buried Histosol or a buried histic epipedon within a depth of 1 meter. They do not have sulfidic material within 1 m of the mineral soil surface.

Histic Almyraquents-These soils are like Typic Almyraquents except that these soils have a histic epipedon. The pedon may be firm or fluid; however, most are fluid.

Hydric Almyraquents-These soils are like Typic Almyraquents except that they became fluid in the subsoil. The trafficability of these soils is good, but have severe engineering or excavation limitations. These soils occur in tidal areas of the Gulf Coast, but are not extensive.

Lithic Almyraquents-These soils are like Typic Almyraquents except the depth to lithic or paralithic contact is 50 cm or less. These soils occur along the Gulf Coast of Florida, but are not extensive.

Psammentic Almyraquents-These soils are like Typic Almyraquents except they are coarser than loamy fine sand throughout the solum. These soils occur along the Atlantic tidal coast.

Salic Almyraquents-These soils are like Typic Almyraquents except they have a salic horizon within 18 cm of the surface. They occur along the tidal Gulf Coast of Texas, but are not extensive.

Sulfidic Almyraquents-These soils are like Typic Almyraquents except that they have sulfidic material at a depth of 50 cm to 1 meter below the soil surface.

Thapto-Histic Almyraquents-These soils are like Typic Almyraquents except they have a buried histic epipedon or buried Histosol within a 1 m depth. These soils occur along the tidal Gulf Coast.

Page 185 - Add:

Distinctions between Typic Hydraquents and other subgroups:

Typic Hydraquents are the Hydraquents that
a. have an n-value of more than 0.7 in all horizons to a depth of 1 m;
b. do not have almyric properties in more than half of the upper 50 cm;
c. do not have a buried layer that has an n-value less than 0.7 within a depth of 50 cm to 1 m;
d. do not have sulfidic material within 1 m of the mineral soil surface;
e. do not have a buried Histosol or a buried histic epipedon that has its upper boundary within 1 m of the soil surface;
f. do not have a histic epipedon.

Almyric Hydraquents are like Typic Hydraquents except for "b".

Almyric Hydraquents are like Typic Hydraquents except for "a", and have an n-value of more than 0.7 between 20 cm and 1 m.

Histic Hydraquents are like Typic Hydraquents except for "f".

Leptic Hydraquents are like Typic Hydraquents except for "c".

Sulfidic Hydraquents are like Typic Hydraquents except for "d", with or without "a" and "f".

Thapto-Histic Hydraquents are like Typic Hydraquents except for "e".

Almyric Haplic Hydraquents are like Typic Hydraquents except for "a" and "b", and have an n-value of more than 0.7 between 20 cm and 1 m.

Almyric ____________________

Almyric Leptic Hydraquents are like Typic Hydraquents except for "b" and "c".

Almyric Thapto-Histic Hydraquents are like Typic Hydraquents except for "b" and "e".

Description of subgroups

Typic Hydraquents-The central concept of the typic subgroup of Hydraquents is that these soils are fluid soils throughout the pedon. These soils are usually clayey and the clays have been deposited in a water environment and have never been exposed to drying conditions except for a few days. These soils occur in fresh water marsh along the Gulf Coast and are extensive in Louisiana.

Almyric Mydraquents-These soils are similar to Typic Hydraquents except that they occur nearer to the tidal region and have been influenced by the added salt content and thus have halic properties in the upper part of the pedon.

Haplic Hydraquents-These soils have a firm surface but are fluid through the other portions of the profile. These soils are periodically drained because of tidal activity and the surface horizon has become firm. These soils are not extensive but are important soils of the Gulf Coast marsh of Louisiana and Texas.

Histic Hydraquents-These Hydraquents have a histic epipedon over the fluid clays. The histic material usually has an n-value more than 0.7, but not always. These soils occur on the older landscape of the alluvial marshes and do not receive additional sediments seasonally. These soils are found in Louisiana, but are not extensive.

Leptic Hydraquents-These soils have fluid clays over a buried firm mineral layer. It is believed that the buried layers were once fluid, but became firm as they were exposed to drying, but as the landscape subsided additional clay sediments have been added. These soils are found in Louisiana, but are not extensive.

Sulfidic Hydraquents-These soils have sulfidic materials within 1 m of the surface or they may be potentially sulfidic if drained. These soils may have a firm surface layer or a histic epipedon. These soils are not extensive in the United States.

Thapto-Histic Hydraquents-These soils have a buried histic epipedon or a buried Histosol. These buried layers may be fluid or firm, but they are usually fluid. These soils are extensive in the coast marsh of Louisiana and intergrade into Histosols.

Almyric Haplic Hydraquents-These soils have a firm mineral epipedon almyric properties in the upper 50 cm of the pedon and are fluid through the other portions of the profile. These soils are influenced by the tidal fluctuations along the sea coast. The extent of those soils is thought to be extensive.

Almyric Histic Hydraquents-These soils have a histic epipedon that has almyric properties. These almyric properties extend into the fluid clays. These soils occur in the brackish marsh of Louisiana, but are not extensive.

Almyric Leptic Hydraquents-These Hydraquents occur in brackish tidal marsh. Fluid clays have been deposited over a subsided firm land surface and the clays have almyric properties. These soils are the saline shallow Hydraquents over firm clays that have subsided and are found in Louisiana, but are not extensive.

Almyric Thapto-Histic Hydraquents-These soils are like Typic Hydraquents except they have almyric properties in the upper 50 cm of the surface and have either a buried histic epipedon or a buried Histosol. These soils occur along the Gulf Coast and are a result of the subsidence of a Histosol with a recent deposition of clayey sediments. In some instances, these soils are a result of a river changing its course and depositing its load over a Histosol. These soils are not extensive in the United States.

Page 186

Distinction between Typic Psammaquents and other subgroups.

Add "d"

d. do not have almyric properties in more than half of the upper 50 cm.

Almyric Psammaquents are like Typic Psammaquents except for "d".

Description of subgroups

Almyric Psammaquents-These soils are like Typic Psammaquents except that they have almyric properties in more than half of the upper 50 cm. They are similar to Psammentic Almyraquents except that they do not have a peraquic moisture regime because of their landscape position. These Almyric Psammaquents occur along the Gulf Coast as soils that line the beaches. These soils are extensive in Louisiana, Mississippi and Texas.

Page 183 - Fluvaquents

Distinctions between Typic Fluvaquents and other subgroups.

Add:

i. do not have fluid layers between 50 cm and 1 m.

Hydric Fluvaquents are like Typic Fluvaquents except for "i".

Hydric Vertic Fluvaquents are like Typic Fluvaquents except for "c" and "i" with or without "a" or "d", or both and the cracks are not open permanently.

Description of subgroups

Hydric Fluvaquents-These soils are the Typic Hydraquents or Haplic Hydraquents that have been drained, but have retained the fluid layers below 50 cm. These soils are extensive in the pump-off areas of Louisiana.

Hydric Vertic Fluvaquents-These soils are similar to Vertic Fluvaquents but there are fluid layers below 50 cm. These soils occur in Louisiana as a result of pump-off. These soils are not extensive.

Histosols

Saprists

Add:

ADC. Other Saprists that have a peraquic moisture regime and have almyric soil properties in more than half of the upper 1 m.

ALMYRASAPRISTS

(Rearrange other Great Groups for alphabetical order.)
Almyrasaprists
These are the Saprists of the coastal marshes that are influenced by daily tides. They are referred to as the salt and brackish marshes.

Definition

Almyrasaprists are the Saprists that

1. have a peraquic moisture regime and have almyric soil properties in more than half of the upper 1 m.
2. do not have a layer of humilluvic materials 2 cm or more thick.

Description of a Typic Almyrasaprists

(Profile description to be added at a later date.)

Distinction between Typic Almyrasaprists and other subgroups:

a. do not have a mineral layer 30 cm or more thick that has its upper boundary in the control section below the surface tier.

Terric Almyrasaprists are like Typic Almyrasaprists except for "a".

Description of Typic Almyrasaprists

The central concept of the Almyrasaprists is fixed on soils that have a thick continuous sapric material below a depth of 30 cm and have almyric properties in more than half of the upper 1 m. Most of these soils are similar to Medisaprists but are saline or have dominant amount of sodium and magnesium because of their position. Other subgroups may be represented, but only two subgroups are proposed at this time: Typic and Terric.

Terric Almyrasaprists-These **Almyrasaprists** are like typic except that they have thick mineral layers within the profile. They are relatively extensive in Louisiana.

Page 334 - Key to great groups

Add:

BAA. Aquods that have a paraquic moisture regime and almyric soil properties in more than half of the upper 1 m.

**HALAQUODS** p. 335

Rearrange other great groups for alphabetical order.

Halaquods

These soils are Aquods that have a peraquic moisture regime and have almyric properties in more than half of the upper 1 meter.

Definition

Almyraquods are Aquods that
1. have a peraquic moisture regime, and
2. have almyric properties in more than half of the upper 1 m.

Distinction between Typic Almyraquods and other subgroups.

Typic Almyraquods are the Almyraquods that
a. do not have a histic epipedon.

Histic Almyraquods are like Typic Almyraquods except for "a".

Typic Almyraquods

These soils are Spodosols that are covered with water except at low-tide. These soils occur on subsided landscapes primarily in Florida. The Typic Almyraquods do not have a histic epipedon and the lack of this soil horizon separates the Typic from Histic Almyraquods. These soils are not extensive, but important soils in Florida.

Page 109 - Distinction between Typic Albaqualfs and other subgroups.

Add:

h. do not have an histic epipedon.
i. do not have a horizon (as thick as 15 cm) with an n-value greater than 0.7 in the upper 1 m.

Histic Albaqualfs are like Typic Albaqualfs except for "h".

Hydric Albaqualfs are like Typic Albaqualfs except for "i".

Histic Albaqualfs

These soils are those prairie soils of Louisiana that are now inundated by fresh marsh. These soils have been inundated for sufficient time for a histic epipedon to have formed.

Hydric Albaqualfs

These soils are similar to Histic Albaqualfs, but lack the histic epipedon. Rather, they have a fluid mineral laver 15 cm thick or thicker over a buried ochric, albic or argillic horizon. These soils occur in the fresh marsh of Louisiana, but are not extensive.

Page 115 - Distinction between Typic Ochraqualfs and other subgroups.

Add:

f. do not have an histic epipedon.

Histic Ochraqualfs are like Typic Ochraqualfs except for "f".

Histic Ochraqualfs

These are the Ochraqualfs that have a histic epipedon over a buried ochric epipedon in the fresh marsh of Louisiana. These are subsided prairie soils and are not extensive.

Page 276 - Argiaquolls

'Distinction between Typic Argiaquolls and other subgroups.

Add:

d. do not have a histic epipedon.
e. do not have a horizon (as thick as 15 cm) with an n-value greater than 0.7 in the upper 1 m.

Histic Argiaquolls are like Typic Argiaquolls except For "d".

Hydric Argiaquolls are like Typic Argiaquolls except f o r

Histic Argiaquolls

These soils are the Argiaquolls that have a histic epipedon and are induated with water during most months. They are the prairie Mollisols that have been inundated and are part of the fresh water marsh of Louisiana. They are not extensive.

Hydric Argiaquolls

These soils have 15 cm or more of fluid mineral material within 1 meter of the soil surface. This fluid mineral material is usually recent deposition over the mollic epipedon. These soils occur in the fresh marsh of Louisiana, but are not extensive.

Committee IX - Soil Surveys for Woodlands and Their Interpretation

Chairman: Pete Avers

Vice-Chairman: Joe Nichols

| | | | |
|---|---|---|---|
| Members: | Hubert Byrd | Dale Snyder* | D. Gray Aydelott* |
| | Bill Goddard | Ken Watterston | |
| | Bob Reiske | Gaylon Lane* | |
| | Jim Gooding | Robert Hinton | |

Charge:

Identify what Forest Land Managers want from soil surveys and develop a technology transfer process, including kinds of interpretations, for meeting those needs.

Work Assignment:

Committee members query Forest Land Managers and specialists on the objective and examine specific sites if possible. Collect ideas on map unit design, size of delineation, reliability, key interpretations, levels of planning, etc.

Sample Foresters, Engineers and Planners in the following groups:

1. Industrial
2. U.S.F.S.
3. S.C.S
4. Others

I. Background

This committee was formed due to an increased interest in utilizing detailed soil surveys in forested areas. Forest management on National Forests has changed rapidly in the past few years and soils information is vital to sound silvicultural prescriptions. Many surveys made in the past are too broad to offer real value in current Forest Management. Woodland managers in private industry are increasingly using more detailed soils information in their management programs.

The committee agreed that useful soil surveys can be made for forestry, utilizing soil taxonomy and existing soil mapping techniques. Refinements and specific considerations aimed at forestry uses could improve applications and

II.

summarized for this report. Summaries from two surveys are attached as appendix. Members on the committee consisted of foresters and soil scientists, two of which were from private industry.

III. Information Needed to Make Soil Surveys More Effective for Forestry

A. Yield data should reflect potentials for the specific survey area.

B. Instructions are needed to users for gathering additional data for the specific survey area.

C. Ideas on minimum size delineation varied from 5 to 50 acres. It was agreed that objectives and conditions in each survey area should guide this factor.

D. The idea was expressed, and generally agreed upon, that modern detailed (order 2) soil surveys should be adequate for forest silvilcultural prescriptions.

E. Instructions on using the interpretive data need to be improved.

F. Clear objectives must be established before a soil survey is made.

G. A better job needs to be done in educating and training foresters and soil scientists. Foresters need training in soil taxonomy and soil scientists in forestry.

H. Soil surveys are being used for three levels of forest planning.

1. Forest-wide plans - order 3 and 4
2. Silvicultural prescriptions - order 2
3. Project level - order 1

Soil surveys are actually compiled with mapping units designed at different levels of intensity or orders to suit the objectives and identified or established condition of the survey area. Surveys made with most mapping units designed at the order 2 level can be compiled or grouped for forest-wide plans. Project level planning will require on-site evaluations and high intensive order 1 type surveys.

c. Texture, mineralogy, stoniness and rockiness.

d. Fertility and reaction.

e. Physical condition.

f. Horizon thickness and organic matter content.

VI. Other Interpretive Needs of Foresters Utilizing Soils Information

Second generation interpretations to be made from the basic soil map or for future consideration when more data is available.

A. Forest fertilization response.

B. Harvesting hazards.

C. Regeneration precautions.

D. Best management practices for non-point pollution.

E. Soil compaction hazard.

F. Landslide or soil slump hazards.

G. Techniques to protect and improve soil productivity.

H. Locations of skid trails, log landings, etc.

I. How to combine map units to make an ecologically homogeneous management unit or capability area.

J. Herbicide use.

Many of the above interpretive needs require evaluation of additional resource inventories and or localized research data to make reliable predictions. The process used to develop second generation interpretations should be explained or available to forest land managers.

VII. Recommendations

The technology transfer process involves several key steps to be successful.

These key steps are:

1. Set objectives of the survey with foresters and forest land managers.

Based on the intended level of forestry to practice; decide on orders of inventory, scale and kind of base photography, kinds of interpretations, data to collect, etc.

2. Take an interdisciplinary approach to mapping unit design.

3. Set up schedules for training those who will be using the survey. Provide indicators to them as to signal a need for on-site study by the soil scientist.

4. Provide instructions and demonstrations on tailor making second generation interpretations and in collecting additional data to meet individual land owner needs. These instructions could be in the manuscript or in some other handbook. The committee felt that it is an important enough consideration to put it in the manuscript.

VIII. The committee voted to continue to the next planning conference primarily due to the interest generated and the increasing intensity of management on forested lands.

A. Suggestions for future committee charges are:

1. To develop instructions for making second generation interpretations, not cookbook but general process.

2. Suggest ways to develop more reliable productivity ratings.

3. Develop training techniques for foresters in soil taxonomy and forest soil management.

## APPENDIX

Following are two summaries of questionaires made for committee work.

I. The first summary was made on the Ozark National Forest by committee member Bill Goddard, Soil and Water Staff Officer, Ozark NF.

Basically, the land managers on the Ozark NF want the following:

1. An accurate soil map.

2. Mapping units designed to predict soil behavior under various management options.

3. Soil interpretations presented in a format to be understandable at the field level, identify problems and what management practices and options are available in resource management that will protect or improve soil productivity.

4. Make sure the manager is aware of the limitations of the soil survey, and when more detailed soil information is needed.

### Design of Mapping Units

The physical or landscape factors need to be described and interpreted as well as internal soil characteristics and qualities. Factors specifically mentioned are aspect, slope shape (convex or concave), position on slope, depth of a horizon, type of land form, description of landforms, geology, vegetation, water (springs, sinkholes, drainage density, etc.), topography and landslides or slumps.

Interpretations

Several needs for soil interpretations were suggested, but the input on how to present the interpretations are practically nil, The fact that sane of the interpretations requested are practically standard for all surveys identifies a problem that the interpretations are not in a usuable or understandable format.

Specific needs identified included:

1. Intensive surveys on planned recreational developments. This also suggests the concept that the limitations of each of the orders of soil survey need to be identified.

2. Interpretations for Forest trails, This should include hiking, jogging, horse and bike trails.

3. Interpretations for off-road vehicles use. This is becoming a severe problem for the Federal and State land managers.

4. Interpretations for sewage systems. The present interpretive classes, based on slight, moderate and severe limitations, are weak. Soils listed with moderate limitations for septic tank filter fields are in fact illegal according to State and Federal health regulations, The interpretations should identify systems or site modification needed for an adequate, legal sewage system.

5. Interpretation should identify resource management techniques or options to protect or improve soil productivity.

6. Maximum non-eroding velocity (for water) under bare soil and sod covered conditions. This is needed by soil horizon for trails, roads, parking lots and other construction and management activities. Road and trail designers would be primary users of this information.

7. External and internal drainage characteristics. This is a normal interpretation in most soil surveys, but needs to be put into a format or language more usable by professions other than soil scientists.

8. Engineering soil classification, particularly sieve analyses and Atterburg limits.

9. Landslide potential.

10. Special requirements for erosion control during construction activities. This is a very timely subject and one that is sorely needed to comply with Federal, State and local clean water laws and regulations.

11. Soil productivity (minerals and nutrients), Probably what is meant here is the probable economic response to vegetation to fertilization and liming,

12. Soil compaction potential and under what conditions is this probability most severe.

13. Suitability for grazing with management alternatives and options,

14. Species suitability. Some woodland groups, because of low site index and steep terrain, are interpreted as "poorly suited" for woodland species, when in fact, this is the best use of the land. A different terminology is needed. The site may be well suited for white oak even though when compared to other sites, productivity is "poor" and management options are low.

15. Mapping unit descriptions should identify potential problems such as slumping, creep and potential for accelerated erosion,

Technology Transfer Process

1. Gear interpretation to field use, not just academic use.
2. Provide user adequate training.
3. Provide concise, accurate maps and interpretations,

II. The second summary was made in the state of Tennessee by Dale Snyder, State Soil Scientist, Tennessee, also a committee member.

This is a summary of responses to a questionnaire sent to about 70 woodland managers and consultants in Tennessee. The questionnaire is attached. The tables list the kind of information used and the number of people indicating use of or need for the information.

Those responding were fran the Tennessee Division of Forestry (25), U.S.F.S. (1), private consultants and commercial holdings (12). Several respondents in the private sector indicated they have no lands to manage - thus the low number in right hand column.

| A. Soil Properties | Tn. Forestry U.S.F.S. | Private |
|---|---|---|
| Texture | 14 | 6 |
| Depth (to rock, pan, water table) | 17 | 6 |
| pH | 10 | 6 |
| Available water holding capacity | 17 | 6 |
| Drainage (internal and external) | 8 | 8 |
| Slope | 1 | 6 |
| Landscape position | 9 | 2 |
| Aspect | 6 | |
| Erosion hazard/potential | 9 | 3 |
| Nutrient level (N, P, K, etc.) | 5 | 1 |
| Bedrock composition | 1 | |
| Parent material | 1 | |
| Organic matter content | 2 | |
| Response to fertilizer | 1 | |
| Depth of A horizon | 1 | |
| Flood frequency | 1 | |
| Toxic chemicals in soil | | 1 |
| Micro organisms | | 1 |

B. Interpretive Information

| | | |
|---|---|---|
| Limitations for roads | 12 | 6 |
| Adopted tree species | 14 | 5 |
| Yield potentials | 10 | 5 |
| Site index | | 2 |
| Equipment limitations | | |
| Adopted exotics for mine reclaim | | |
| Existing tree species | | |
| Understory species | | |
| Weed competitors | | |
| Previous use | | |
| Wildlife habitat suitability | | |
| Current and potential land use of forested and non-forested sites | 1 | |
| Effects of logging roads used during thinning of pine plantations on soil structure and tree growth | 1 | |
| Soil-water regime differences between forested areas around reservoirs and those on same soil type not associated with reservoirs | 1 | |
| Opportunities for the use of pellet herbicides | 1 | |

C. Minimum Size Management Area

| | |
|---|---|
| 1 acre or less | |
| 2 - 3 acres | |
| 5 acres | |
| 5 - 10 acres | |
| 10 acres | |
| 20 acres | 1 |
| 25 acres | 2 |
| 40 acres | 1 |
| 50 acres | |
| 50 - 200 plus | 1 |
| 160 | 1 |

D. Source of Soils Information

| | |
|---|---|
| In-house soil scientist or forester | 1 |
| Extension Service | 1 |
| SCS soil scientist or conservationist | 5 |
| Private consultant | 0 |
| Published soil survey | 6 |
| Soil survey interpretations for woodland | |
| U.S.F.S. Experiment Station | 1 |
| U.S.F.S. publications | |
| Tennessee Valley Authority | |
| Soil series descriptions | |
| Didn't know information available | |